SPRING MANUAL OF PRACTICE IN ECONOMIC ZOOLOGY.

WHAT TO DO IN SPRING AGAINST THE MORE IMPORTANT INSECT PESTS OF THE FARM, ORCHARD AND GARDEN.

OHIO
Agricultural Experiment Station.

WOOSTER, OHIO, U. S. A., NOVEMBER, 1908.

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[1]In cooperation with the College of Agriculture, Ohio State University, Columbus.
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BULLETIN

OF THE

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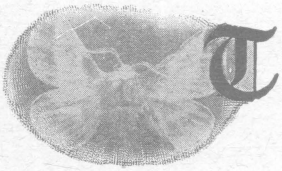
SPRING PRACTICE IN ECONOMIC ZOOLOGY.

BY H. A. GOSSARD.

PREFACE.



THE present compilation is the second number of a series of Manuals of Economic Zoology, to be issued in four numbers corresponding to the four divisions of the year. The Winter Manual was issued in 1905; the Summer and Autumn compends will follow within the coming year. The present number is the most important one of the set.

The tables for general treatment of fruits have been made to cover the entire year, since it would be practically impossible to make them conform to exact time limitations. Professors Selby and Green have kindly assisted in preparing the tables from the standpoint of fungicides and practice, and these may therefore be regarded as summing up the best experience and knowledge of the Station officers. Practically the same matter is furnished in the spray calendar, the chief difference being that the tables are somewhat fuller from the entomological standpoint. For information concerning spray formulae, etc., see the spray calendar, Bulletin 199.

The time schedules assigned for work, and the appearance of the various insects, must be regarded as only approximate and subject to considerable variation because of weather conditions, latitude, etc. The periods of expected appearance for the insects mentioned will be found approximately accurate for central Ohio in average seasons. Southern Ohio should look for them a little earlier, and northern Ohio, a little later than the dates given. The

Manual is intended as a textbook or practice, and the writer believes that the time key will be useful to the agriculturist in forewarning him what to expect and look for in his fields and orchards. The ordinary type of manual is consulted "after the thief has entered the stable and stolen the horse" while it is hoped that the present arrangement will induce many farmers to look forward and see what enemies are to be expected in the weeks immediately ahead, and what efforts should be made to forestall them. Orders for insecticides, machinery, etc., can be planned accordingly. The experience of many years, and the accumulated reports of thousands of observers will be needed to furnish an accurate time schedule for such a manual, and we therefore solicit reports from our friends in the state, confirming or changing the schedule herewith tentatively offered. The facts set forth in the manual have been drawn from many sources. The writings of Saunders, Chittenden, Sanderson, Smith, Slingerland and Pettit have been frequently consulted, but I have also drawn freely from the writings of others. The publications of the U. S. Biological Survey have furnished valuable help. My thanks are also due to my efficient assistant, Mr. W. H. Goodwin, who has had full charge of all the illustrative work of the bulletin.

GENERAL MANAGEMENT.

INJURIES BY INSECT ENEMIES MAY BE ANTICIPATED AND PREVENTED.

Having decided what crops are to be grown for the year it will be worth the farmer's while to look through this Manual and by reference to the sections treating of these crops, see what pests are apt to attack them during the spring and if steps can be taken before planting time, at planting, or soon thereafter, to prevent or minimize anticipated injury. Such investigation may render a change of plans advisable at the outset and thus future annoyance and loss may be saved. After the crops are planted, consult the Manual at the beginning of each month and keep a lookout for such insects as are likely to cause trouble in the near future. Not only will this attention save loss from insects, but the growers determination to successfully carry his crops to maturity will be increased, and his interest in all other factors relating to their health and vigor will be stimulated. Again, the insects themselves will become creatures of interest because they are subjects of first-hand acquaintance.

ROTATION OF CROPS.

In the case of field and garden crops, not only is rotation necessary as a means for conserving soil fertility, but it is of the utmost importance as a means to control injurious insects and fungous diseases. It is unwise to grow the same specific crop for two successive years on the same soil, and it is even unwise to grow two different but closely related crops following each other, for example, rape or turnips should not follow cabbage, lest they be attacked by some of the various cabbage worms or by root maggots; also egg-plants or tomatoes after potatoes are apt to be attacked by flea-beetles. It is likewise bad practice to plant crops following each other that are badly attacked by the same insects, though the two crops are not closely related in a botanical sense. When the common STALK BORER, *Papaipema nitela*, is abundant in corn, it will in all probability destroy a crop of tomatoes immediately following the corn. All things considered, a systematic and regular rotation, properly planned, is probably the most effective means for controlling the majority of insect pests which attack field crops.

FERTILIZERS.

Plants that are badly attacked by insects can often be stimulated to outgrow the injury by a liberal application of fertilizer. From the entomological standpoint, commercial fertilizers are in many cases more desirable to use than barnyard manure; for instance, root maggots flourish in organic matter, but are discouraged or killed by such commercial fertilizers as kainit and nitrate of soda. As a matter of course, all soil, to produce well, must have a certain amount of humus in it and barnyard manure must sometimes be applied in liberal quantity. The increased vigor of plants growing in a well manured soil, generally more than counterbalances the damage caused by the greater number of insects which are sometimes thereby developed.

CLEAN FARMING.

CHINTZ BUGS, SQUASH BUGS, and hundreds of others hibernate in grass and weeds, or beneath rubbish, such as old boards, during winter, and may be destroyed in early spring by burning. Many insects feed upon common weeds in the spring before crops of value are planted or have appeared above ground. An illustration is found in the CORN ROOT LOUSE which feeds upon the roots of smartweed until the corn appears. The free use of the weeder in early spring is one of the preventives of insect damage. Whenever any crop has been harvested, grub out and destroy all remnants of stems, roots and leaves by burning, or by deeply burying them.

NATURAL FRIENDS AND ENEMIES.

DOMESTICATED ANIMALS AND BIRDS.

These will be considered only in the relation they sustain to insects, since this role in their lives is less comonly known, or at least is less appreciated, than their offices in supplying meats for human consumption, and assisting to maintain the fertility of the land and the like. CHICKENS and TURKEYS devour many caterpillars and other insect forms. They will often save the plum and peach crop from ruin by the curculio if they have free access to the orchard. On the other hand, they are liable to scatter scale insects over an orchard if they are allowed to roost in trees that are infested with scales. Chickens and turkeys may be taught to follow the plow in flocks and will pick up white grubs, cutworms, etc., in great numbers. The GUINEA FOWL is a most persistent and voracious insect hunter and, if allowed some freedom, is a much wider ranger than other domestic fowls. PIGEONS devour some insects and many weed seeds. Pigeon crops sometimes contain many of the pupae of the sheep tick which they have picked from the wool of living animals. DUCKS and GEESE also devour considerable numbers of insects.

HOGS are very useful in contending with white grubs and subterranean insects. If a sufficiently large herd of hogs can be turned loose into an infested field the fall before it is to be planted to a new crop, and continued therein until seeding time the next spring, they will do more than any other agency to insure a good harvest from such land.

WILD ANIMALS.

Rats: These animals may be destroyed by making a dough of barium carbonate, otherwise known as barytes, and oatmeal, one part by measure of barytes and eight parts of oatmeal being well mixed together and moistened sufficiently to make a stiff dough. Cornmeal may be used instead of oatmeal, or the barytes may be spread on bread and butter, or on moistened toast, or on cheese. Place the bait in the runways of the rats, a small bit in a place. This poison has neither taste nor smell and, in such small quantities as used for rodents, is comparatively harmless to larger animals. It acts somewhat slowly, but this is an advantage rather than not, since the sickened animals nearly always leave their burrows and die in the open when searching for water. The stench which would arise from the decaying bodies of the rats remaining in their holes is thereby avoided. If one application does not rid the premises of the pests, repeat the poison dose with a change of bait.

Dry strychnine crystals may be concealed in incisions made in bits of raw meat, or hidden in Vienna sausage, or in toasted cheese and thus scattered in rat runs, but this method is not advisable in human habitations, since the poison operates quickly and the carcases are almost certain to remain in the holes, often making an intolerable stench.

Oatmeal or cornmeal may be wet with a strychnine solution and scattered in the same way. This solution is made by dissolving one-half ounce of sulfate of strychnine in one pint of boiling water. One pint of thick sugar syrup is added and the mixture is well stirred. Use enough of this solution to moisten all the bait. Wheat soaked over night in the solution is sometimes used as a bait. If the animals are fed for one or two nights previous to baiting, on unpoisoned bait of the kind chosen for use, success will be made more certain.

Trapping is one of the best ways for controlling rats. Guillotine traps are best and may be baited with bacon or Vienna sausage (Wienerwurst). Other baits to use with traps are toasted cheese, toasted bread and butter, pumpkin seeds and oatmeal. Handle baits and traps as little as possible. If the hands are gloved with thick material, but little worn, and powerfully scented with aniseed, caraway, or other strong smelling substance, success is said to be more certain. After traps have been handled a good deal, they are improved by being smoked or smudged for a few moments.

Rats may be destroyed in their holes, when these are located in fields or along banks and roadsides, by fumigation with bisulfid of carbon.

The use of concrete cement for cellars, basements, foundations, barn floors, cisterns, etc., reduces suitable locations for burrows to a minimum, and damage by rats about buildings will largely cease when the use of this material has become widespread. Corn cribs may be protected against depredations of rats and mice by being lined with strong, fine-meshed wire netting.

Foxes, skunks, weasels, cats, dogs, owls and hawks destroy rats as opportunity offers. Ferrets and a pack of dogs, trained to work together by an experienced rat catcher, can accomplish much with a day's effort.

Mice: About dwellings, trapping is the preferable method of control. Traps and cats together are often sufficient to keep them subdued in barns and outbuildings, but these sometimes need to be supplemented with poison. The poison baits recommended for rats are equally good for mice. Field mice may be destroyed with the same baits, scattered under boards or similar shelters, away

from the reach of valuable birds. Wide boards, with inch cross-pieces nailed under them, are suited for this purpose. Or pieces of drain tiles can be laid along the trails and the poison can be placed inside with a long handled spoon. Old tin cans, with their ends compressed, or with small openings in their ends, may be used instead of tile. In orchards and nurseries, the trees may be protected in early spring and in winter by cutting small twigs, such as the suckers from apple trees, dividing them into suitable short lengths, and dipping them into the strychnine syrup solution. These poisoned cuttings are scattered along the tree rows and are eaten by both mice and rabbits, while they do not endanger birds or other animals. Meadow mice devour many useless wild plants and weed seeds, but are certain to do much harm to orchard and nursery trees when snow is on the ground, especially if they are abundant. They also devour many insects, some injurious ones, and some valuable ones—such as the young of bumble bees, these latter insects being of much service to the producer of clover-seed. All things considered, we think it wise to destroy as many of these mice as possible.

Mechanical protectors are much used for young orchard trees. Cylinders of fine-meshed wire are valuable. Sections of corn stalks are sometimes packed and tied into cylinder form around the bases of the trees and give good satisfaction. Newspapers tied around the trunks, next to the ground, are of some value.

On a large scale, a thick Bordeaux mixture is said to be useful to the nurseryman. Make a thick white-wash, about the consistency of cream, to which add enough blue vitriol to give a "robin's egg blue" color. Paint on the trunks to a height of 18 to 24 inches or more.

Rabbits: I am assured by parties who have tested the remedy that young and succulent plants such as garden peas, cabbage, etc., of which rabbits are especially fond, may be protected by being dusted, while the dew is on in the morning, with dried blood, or dried blood and bone ground into a powder—the form commonly furnished by the fertilizer factories. Read the preceding paragraph on mice for additional information.

Moles: These little animals work altogether underground, feeding on earthworms, grubs, beetles, and a limited amount of vegetable matter. It seems certain that they do more good than harm, but because of their habit of injuring lawns and gardens, it is sometimes considered expedient to kill them. Their destruction is probably most readily accomplished by making use of a good mole trap, various patterns of which are offered on the market. Moles have particular periods of the day when they work most freely, and

if their mounds are carefully and silently watched during their working hours, it is often possible to locate their exact whereabouts. By means of a quick, strong thrust it is possible to fling a shove blade beneath the creature at the moment the movement in the mound is observed, and throw it with the loose earth to the top of the ground. Or a many-tined fork may be flung into the earth with full force, when the movement is observed, and the mole will probably be impaled on the fork. A light charge of shot fired into the mound, coincidentally with the movement, would be almost certain to kill the animal. Use but little powder for such an attempt.

Shrews: These little animals are generally mistaken for mice, and one species with a burrowing habit is usually confounded with the moles. The mole shrew is of rather stout build, tail about one inch long and it possesses short legs and a pointed nose. The fur is very fine and glossy, the eyes very small, the ears almost imperceptible, and hidden in the fur. The front feet of the burrowing shrew are slightly enlarged for digging, but are widely different from the expanded flippers of the mole. The front and hind feet of most shrews are like those of mice. The mole shrew is a common Ohio species. It makes underground runways that show as elevated ridges on the surface of the ground in gardens and lawns, but does not make the characteristic mounds or mole-hills of the true mole. The shrews are on the whole very beneficial to the agriculturist and deserve protection. Some live almost entirely above ground, and even the mole shrew spends a good part of its life above ground. A single shrew will destroy hundreds of young meadow mice in a season, if opportunity offers. Young rats are also devoured by it, and it has the reputation of being able to overcome creatures larger than itself. Shrews also eat great numbers of earthworms, sowbugs, slugs, white grubs, grasshoppers, ground beetles and other insects. When the mole shrew becomes too plentiful in lawns and gardens, it can probably be killed by strychnine inserted into bits of meat which are put into the freshly-made burrows; but it is questionable if this creature should be interfered with, even under these annoying circumstances.

Skunks: These animals, like the shrews, are among the farmer's very best friends. While an occasional individual takes a liking to young poultry, and should then be destroyed, the great majority do not molest the chicken yard, but do consume an enormous number of June beetles, white grubs, grasshoppers, crickets, field-mice, etc. This creature is probably the most valuable animal in existence for controlling the white grub. It devours both beetles and larvae greedily. Its good offices are partially counterbalanced

by the destruction of the eggs and young of valuable birds, also of young rabbits and young shrews whenever opportunity offers. We can spare the rabbits without much, if any loss, and on the whole, the skunk deserves protection.

Woodchucks: These are vegetable feeders, living on garden products, fruits and tender pasture grass. They are, generally speaking, injurious, and possess no specially beneficial traits. They may be caught in strong steel traps or killed by a charge of buckshot from a close, hard-shooting gun. The skin is very thick and tough and it is useless to attempt to kill them with small shot, or a light load.

A large wad of rags or of cotton may be saturated with bisulfid of carbon and pushed into the animal's burrow, the opening being closed with a stone or chunk of wood, over which loose earth is shoveled to shut in the fumes. All openings to the burrow, except the one used for fumigating, should be closed before the gas is used. It requires only a few minutes of fumigation to kill the woodchuck in the burrow.

The Toad: The toad is a very valuable friend, especially to the gardener. Toads live for several years and by preference remain on the same feeding grounds from year to year. About 98 percent of the toad's food consists of animal matter. Among the forms regularly eaten are angle worms, snails, sowbugs, thousand-legged worms, spiders, ants, grasshoppers, crickets, cutworms, beetles and various caterpillars. From 60 to 80 percent of injurious insects and a small percent of beneficial insects go in with its customary ration. The stomach is filled and emptied about four times in each 24 hours. Upon the basis of stomach examinations, it has been estimated that during the 90-day period extending over May, June and July, a grown toad will consume 2160 cutworms, 1800 myriapods or thousand-legged worms, 2160 sowbugs, 3240 ants, 360 weevils, and 360 ground beetles, the last being beneficial insects. The sum total, therefore, for the 90 days, is 360 beneficial insects and 9720 injurious ones destroyed. Mr. A. H. Kirkland, who made the foregoing computations, observes that children are often paid one cent for each cutworm they kill, and that on this basis, after allowing ten percent deduction from the total number consumed, to offset the probable number that would have been killed by the devoured ground beetles, we still have 1944 cutworms to the toad's credit, or in money value it is worth $19.44 in 3 months time. English and French gardeners appreciate the value of toads and as high as $25 per hundred is said to be often paid for them. Owing to the dislike of the creatures for new and unfamiliar surroundings, it is advisable in many cases to provide a breeding pool for them in order

that the young may establish themselves where they are wanted. A shallow pool of cement, having a small but constant water supply is sufficient, and the old toads should be carried to it at mating time, which in this latitude comes in April and May. Stagnant water is better than running water from the standpoint of the toad raiser. The young toads will leave the water by midsummer, or before mosquitoes become abundant, and the pool should then be drained to prevent mosquito breeding. A small indoor aquarim, protected from mosquitoes by screens, may prove more satisfactory than an outdoor pool. Supply with fresh-water plants and clams, and feed the creatures with bits of dog biscuit or chopped fresh meat as needed. Do not feed more of any feed than the toads and tadpoles will consume, or the water will become contaminated. The outdoor pool can be screened against mosquitoes, if desired, provided the toads are fed.

For garden shelters, make shallow holes in the ground and cover with flat stones or boards. The toads will retire into these in the daytime and come forth at dusk for their nightly forays. Toads are specially valuable to greenhouse men, keeping down slugs, snails, sowbugs, thousand-legged worms, plant lice, cutworms, etc.

PLATE I
A Garden Toad. The Gardener's Friend
Photo by Goodwin.

BIRDS.

Want of space prevents any adequate treatment of these important allies of the farmer. Farmer's Bulletin No. 54 on "Some Common Birds in their Relation to Agriculture," may be obtained from the U. S. Department of Agriculture and gives much valuable information. Weed and Dearborn's "Birds in their Relation to Man," (J. B. Lippincott Co., Philadelphia) is a very valuable work from the economic standpoint.

The following notes upon some of our common birds and bird groups gives some meager information regarding their usefulness:

Quail: A great feeder upon weed seed of all kinds. Over 60 percent of its food is weed seed. It devours great quantities of the seeds of ragweed, pigweed, sheep sorrel, paspalum, jewell weed, pigeon grass, etc. The stomachs and crops of 13 birds, shot and examined by the U. S. Biological Survey, contained, even though only partially filled, 5,582 weed seeds. One crop contained 400 pigweed seeds, a second 200 seeds of ragweed, a third 620 seeds of pigeon grass, and a fourth 550 seeds of sheep sorrel. It also eats freely of our worst insect pests, grasshoppers, chinch bugs, Colorado potato beetles, striped cucumber beetles, May beetles, army worms, cutworms, etc. A more valuable bird does not live on the farm.

Mourning Dove: As a weed consumer it has habits similar to the quail, but eats few or no insects.

Cuckoos: Great feeders upon caterpillars, devouring hairy ones as well as smooth ones. The tent-caterpillars and fall webworms, which are usually shunned by other birds because of their hairiness, are greedily eaten by the cuckoo or rain crow. Stink bugs, grasshoppers, beetles and spiders are also eaten.

Crow: This bird devours grasshoppers, cutworms, May beetles, caterpillars, frogs, toads, snakes, eggs of all kinds, young birds including young chickens, mice, crayfishes, snails, some grain and also a little fruit. It has the mischievious habit of pulling up sprouting corn, also of eating green corn ears while "in the milk."

Some one or more of the following methods may be tried to protect seed corn from crows:

1 "Tar the seed corn as follows: Put one-fourth to one-half bushel of corn in a half-barrel tub; pour on a pailful of hot water, or as much as is necessary to well cover the corn; dip a stick in gas tar and stir this briskly in the corn; repeat until the corn is entirely black; pour off onto burlap (bran sacks are excellent); spread in the sun and stir two or three times during the day. If this work is done in the morning and the day is sunny, the corn will be ready for the

planter the next day without any other care. The hot water softens the tar so that just enough adheres to the corn, and the corn is completely glazed by the sun. This is by far the quicker way of tarring corn, is harmless and effectual, and I have for years planted with a machine corn treated in this way."*

2 "Scatter soaked corn often about the borders of the field."

3 "Plant the seed three or four inches deep. This is said to prevent corn-pulling by crows and must be effectual on heavy soil."

4 "Surround the field with a line of twine, strung on upright poles, and suspend rags, streamers, pieces of bright tin, etc., from the twine."

5 "A frequent change in scarecrows is advisable. A barrel hung on a leaning pole puzzles the crow."†

6 A crow can sometimes be coaxed into a steel trap. An egg is so exposed that the bird can only obtain it by stepping into the trap, which is carefully concealed under loose earth. One or two dead crows procured by this or any other method will usually keep the others away for one season.

7 A long range rifle, fired from concealment, will make the birds wary of the neighborhood, especially if one or two are killed and hung up in the field.

Robin: A few birds remain in Ohio during the winter, but in general the robin is migratory and it is one of the early comers northward in spring. Over 42 percent of its food is animal matter, principally insects, while the remainder is largely made up of small fruits and berries. Of the 58 percent of vegetable food, over 47 percent consists of wild fruits, and a little more than four percent of the cultivated varieties. During June and July, the percentage of cultivated fruit rises to 25 percent, but in view of the great service the bird renders throughout the year, we can well afford it a share in the cherry and small fruit crop. Grasshoppers make up one-tenth of the food and in August constitute over 30 percent.

The Russian mulberry ripens about the same time as cherries, and mulberries are preferred by robins and most other fruit loving birds before the commonly cultivated fruits. Therefore, the fruit-grower should plant a mulberry here and there over his plantation.

Meadowlark: Grasshoppers make up 29 percent of its food for the year and comprise 69 percent of it in August. About 21 percent consists of beetles, two-thirds of which are harmful. Caterpillars, cutworms, ants, chinch bugs, wasps, etc., bring up the total percentage of insect food for the year to 73 percent. The 27 percent of

* Ethan Brooks in An. Rept. Mass. State Board of Agric., 1896.

† E. H. Forbush in "Useful Birds and Their Protection," Mass. Board of Agric., 1907.

vegetable matter is about one-half grain and the other half weed seed. Most of the grain consumed is waste grain left in the field. This is a very useful bird, with no serious faults of any kind.

Woodpeckers: These birds perform a service to mankind for which no other creatures are adapted. They are, before all other birds, the conservators of the forest and orchard. Those insects, which because of their insidious habits, are beyond the discovery of other birds, and generally of man himself, constitute the common prey of the woodpeckers. Bark-borers and borers into the heart-wood, insects which strike for the vitals of the tree, are diligently sought for, winter and summer, by these birds. The ants, which burrow into decaying wood and thus extend and expose a greater surface to decay, are also eaten in large quantity. There is one disreputable member in the family, which puts the whole group under suspicion with people who do not carefully discriminate. This is the villanous **Sapsucker**, or **Yellow-bellied Woodpecker**, which makes rows of punctures in horizontal or spiral series in the bark of many trees. These punctures extend into the cambium or sapwood and when they become filled with sap are sucked dry by the bird. So many of these punctures are often made upon a tree that the effect is that of girdling it, and the tree dies. Sugar maples and coniferous evergreens are favorite objects of attack, but orchard and forest trees suffer also. While the bird eats a good many insects, I believe the shot-gun should be used whenever it is found to be attacking valuable trees.

Warblers and Vireos: The last week in April and the first week in May, for the southern and the northern parts of the state respectively, usually see the warblers migrating from their southern winter resorts to their Canadian breeding grounds. The vireos come at the same time, some of these remaining as summer residents. The following quotation from Dr. Elliott Coues gives a good idea of the activities of both groups, which possess similar habits:

"With tireless industry do the warblers befriend the human race. Their unconscious zeal plays due part in the nice adjustment of nature's forces, helping to bring about that balance of vegetable and insect life without which agriculture would be in vain. They visit the orchard when the apple and pear, the plum and cherry are in bloom, seeming to revel carelessly amid the sweet-scented and delicately tinted blossoms, but never faltering in their good work. They peer into the crevices of the bark, scrutinize each leaf, and explore the very heart of the buds to detect, drag forth, and destroy these tiny creatures, singly insignificant, collectively a scourge, which prey upon the hopes of the fruit grower, and which, if undisturbed, would bring his care to naught."

Orchard plant lice, which are just beginning to appear in force in early May, are devoured in great numbers by warblers and vireos.

Sparrows, Finches, Buntings and Grosbeaks: Usually small and sober colored birds, nearly all of which are valuable. Weed seed and insects make up the bulk of the food for the majority of these species. The **Pine Grosbeak** and the **Purple Finch** feed upon the buds of orchard and forest trees, but probably compensate for the damage in generous measure by their consumption of insects and weed seed. The **English Sparrow** is the most questionable member of the family. This bird destroys the buds and blossoms of fruit and shade trees, eats largely of grain and cultivated fruit, and drives our native birds away from their nesting places, taking pains also to annoy the latter on all possible occasions. They feed their young with a large proportion of insect food, but are not desirable neighbors, all things considered. One method of fighting them is to allow them to take possession of the boxes and nests that have been prepared for other birds, and then periodically destroy their eggs before any have time to hatch. After a year or two of this treatment they are glad to leave the nests to the more valuable natives. Poisoned wheat may be used for their destruction, but care must be taken not to expose it for other birds, and it must therefore be sown in small quantities where the sparrows will find it and devour all of it. Prepare the wheat as follows: Dissolve two drams of strychnine in three quarts of boiling hot water and keep boiling until the poison is all dissolved. Stir a peck of wheat into the water and allow to stand for 48 hours. Then spread the swelled grain over the bottom of a pan or in paper plates and allow to dry in the oven of a hot stove, stirring the while to prevent scorching. The birds will not eat scorched grain. Snowy, cold weather is the best time for spreading the bait.

Orioles, Blackbirds and Jays: The **Orioles** are very valuable insectivorous birds. Blackbirds are also of value. Even the **Crow Blackbird or Bronzed Grackle** does far more good than harm, 48 percent of its food consisting of animal matter, chiefly insects. The **Red-winged Blackbird** eats insects to the extent of 26 percent of its food. Weed seed comprises 57 percent and grain 13 percent. The **Blue Jay** eats nuts (acorns, chestnuts, etc.,) to the extent of about 42 percent of its food, devours considerable grain, also the eggs and young of smaller birds, and insects to the amount of 19 percent of its food. Owing to the harm it does to other birds, it is probably more injurious than beneficial. The **Bobolink** is a valuable bird in the north, subsisting almost wholly on insects and weed-seed; but in the south it is a scourge to the rice growers.

Fly Catchers, Swifts, Night-Hawks and Humming Birds: All of these are valuable. Most of them catch their food while flying through the air. Over 93 percent of the food of the **Phoebe** or **Pewee** consists of insects, the Kingbird includes 90 percent of insects in its menu, and the percentages eaten by the **Night-Hawk** and the **Whip-poor-will** are very similar.

Shrikes, Swallows, Waxwings and Tanagers: The **Shrikes** are valuable as mouse-killers and, while they butcher some beneficial birds, their beneficial qualities are estimated by good authorities to outway four to one their injurious ones. All the **Swallows** are beneficial. The **Purple Martin** is especially valuable, and will nest in boxes provided for it near human dwellings. The **Waxwings** or **Cedar Birds** are valuable, on the whole, though they sometimes eat cultivated fruits. The Tangers eat both insects and fruit, chiefly wild berries.

HOW TO ATTRACT THE BIRDS.

In spring far-reaching plans, which look a decade or more into the future for their full consumation, may be laid for the encouragement of bird increase. Plant here and there over the farm, near the house and near the orchard, clumps of trees from one-eighth to one-fourth acre in extent, consisting of evergreens, pines, spruces, firs and hardwoods intermingled. These will furnish winter retreats and summer nesting places. Scatter among such clumps, and also at other points on the farm, such trees as the Russian mulberry and the choke cherry to supply enticing food for the birds. Other trees, shrubs and vines, the fruit of which is inviting to birds are Juneberry, dogwood, mountain ash, juniper, hawthorn, elder, viburnum, barberry, wild plum, blackberry, cherry, raspberry, wild grape, catbrier, sumach, hackberry, shad-bush, honey-suckle, wax myrtle, etc. Plant a variety of these so as to furnish a succession of ripened berries for all periods of the year. Also a variety is needed to encourage nesting. Certain species prefer particular kinds of trees for nesting. Thus, the Baltimore orioles prefer elms; the goldfinch, and the warbling vireo, maples; the brown thrasher and catbird, thorny tangles of shrubbery, etc.

In the spring, before the summer rush of work comes on, is also a convenient time to put up a goodly number of bird houses about the farmstead, in the woods, and in the orchard. The floor space for these houses should be about 6x6 inches, and several such compartments may be bunched together into a colony house or "tenement" for such birds as martins, tree swallows, and pigeons. The doorway should never be made larger than necessary to admit the bird. Make a perch or doorstep below each door. A wooden pin driven

into an auger hole makes a good perch. Martins and tree-swallows like to nest 26 feet or more above the ground, but other birds usually prefer an elevation of less than 12 feet. Houses made of weather-beaten boards are more attractive to birds than new or painted ones. If the English sparrows appropriate the boxes, allow them to lay their eggs and then destroy every egg before it hatches. After a year or two of this treatment the boxes will be left to their more valuable neighbors. Protect the houses from cats by running a close spiral of barbed wire around the trees or poles which sustain the houses, fastening the wire in position with staples. Gourds with one side cut away to make a door, and hollowed out, may be swung from tree limbs or telephone poles and make attractive houses for several species of birds. Place the houses where they will be shaded from the beating rays of the sun and protect the entrance against dashing rains.

At nest-building time, robins, swallows and phoebes will much appreciate a box of clay mud, placed within easy access, which is well wetted with water two or three times per day. Orioles, cedar birds and kingbirds will pick up bits of yarn put on limbs of trees or fences for them. Woolen strips cut from discarded clothing will be gladly utilized by some species. Make all such strips not more than 10 or 12 inches long. The following list of materials comprises those that are most utilized by various birds for nest construction: rootlets, hair from horses and cows, bits of birch bark, bits of newspaper, straw, fine hay, feathers, thread, twine, cedar or grapevine bark, rope yarn, mud, and sphagnum moss. Put these where the birds have access to them.

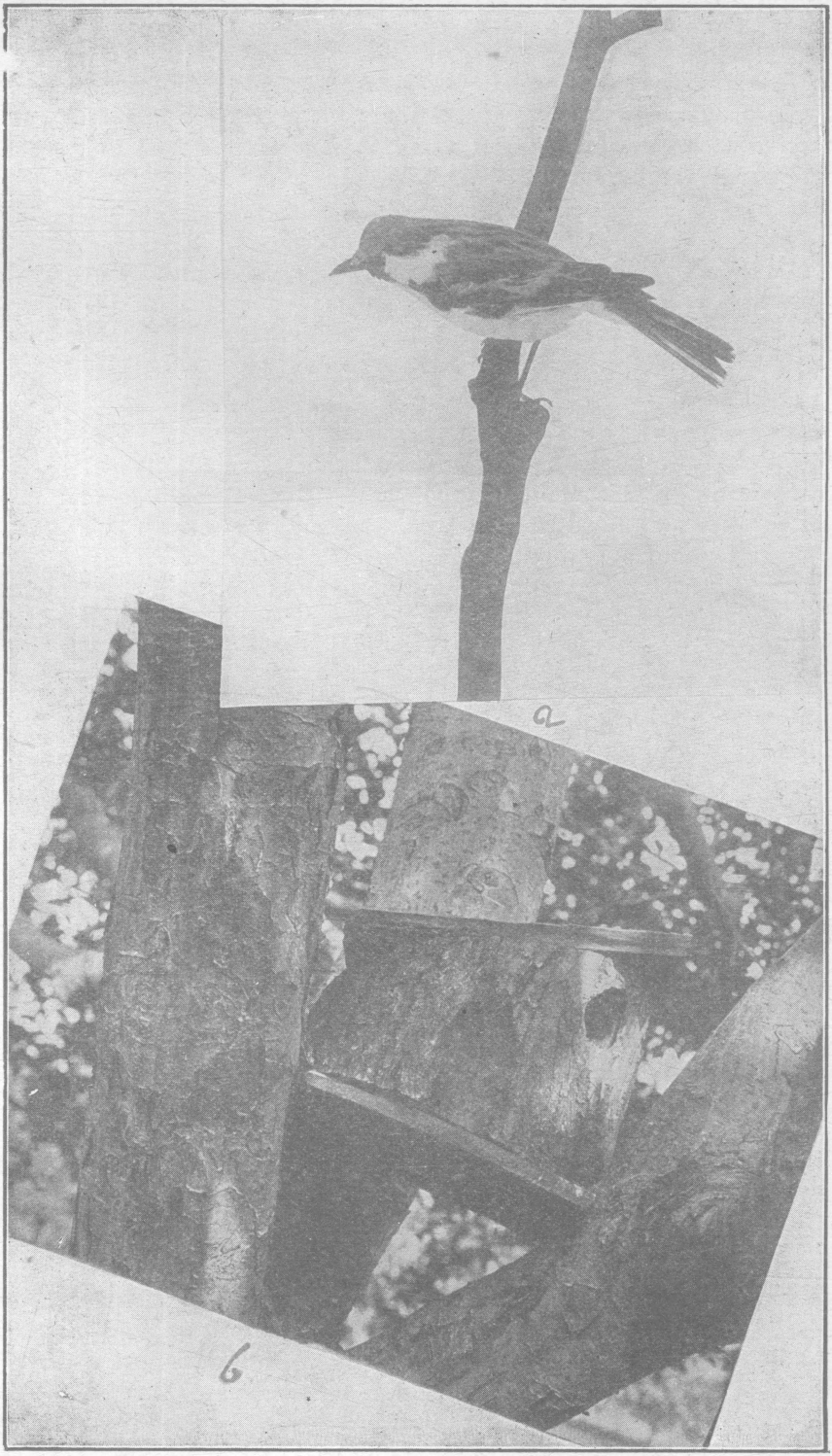
Arrange a bathing and drinking place near the house and also, if convenient, in the orchard and in the garden. Arrange the bath so the birds will not be exposed to attack by cats and hawks while indulging themselves. A shallow pan set on the window shelf or on a post on the shady side of the house, or in the shade of a tree at an elevation of four or five feet from the ground, will be satisfactory. A shelving stone should be put in the pan to give varying depths of water from one-half inch to two inches. Where running water is available, a drinking fountain may be constructed on a similar plan, always taking care to have some shallow water and to have the approaches to the spring so open to the view from all sides that the birds can readily detect the approach of danger. Tall weeds and grass should not be allowed to grow around springs and pools, not elevated above the surface of the ground, else lurking cats are almost certain to waylay many helpless birds while their feathers are wet. If filled pans are used, the water should be changed every day.

EXPLANATION OF PLATE II.

a Chestnut sided warbler. One of the friends of the orchardist.

b Bluebird home. One of the methods of encouraging useful birds to nest in the orchard.

Negative by Houser.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The more serious enemies of birds should be discouraged, especially at breeding time. Hawks, crows, jays, squirrels and cats need to be shot in nearly every case where they are found to be molesting valuable birds.

MIGRATION RECORDS OF BIRDS.

In the Appendix, pp. i-v, are given the dates on which a large number of our feathered friends have been observed at Wooster, and by reference to it, the reader can readily determine what species of birds he is likely to encounter at any time in spring.

INSECT PARASITES AND DISEASES OF INSECTS.

Were it not that the insect household is divided against itself, parasitic and predaceous forms constantly destroying both near and distant kindred, all vegetation would be consumed in a few months and the human race would as quickly perish. Bacterial and fungous diseases are often exceedingly important checks upon the excessive multiplication of insects. A good Manual of Economic Entomology, such as Smith's (published by J. B. Lippincott Co., Philadelphia), will give valuable assistance in recognizing such helpers.

FARM TREATMENT.

INSECTS INJURIOUS TO VARIOUS GRASSES AND GRAINS.

MARCH--APRIL.

The CHINCH BUG, *Blissus leucopterus*, hibernates during winter under old boards and rubbish or in trash or grass around the borders of old fields, especially wheat fields. Such borders should be carefully burned over in very early spring in infested districts if such work was neglected in fall and winter.

GRASSHOPPERS lay their eggs in compact ground, especially along roadsides and in the uncultivated borders of fields. Bare, high, sandy ground and closely grazed pasture land, is especially resorted to for egg-laying. The eggs are laid in the fall in masses of about thirty, about an inch beneath the surface of the ground, in pod-like cavities. Disking the land in early spring before hatching time will destroy most of the eggs. The young hatch from about the middle of April to the middle of May in Ohio, depending upon the forwardness or the backwardness of the season. The young nymphs may be be poisoned with bran mash, (see p. 78) or oftentimes destroyed by burning. If the stubble or rubbish on the ground is insufficient to

burn, scatter straw over the field and on cool days, when the insects have crept beneath it for shelter, set on fire. If the surface of the ground is level, a heavy roller run over it will crush many of the nymphs, especially on cool days or in the morning and evening.

When the nymphs are very numerous over large areas it is best to resort to ditching. The ditches are made two feet wide and two feet deep, with vertical sides. The sides next to the field to be protected must be kept finely pulverized and not allowed to become washed out or hardened. The right condition may be kept by dragging a brush composed of dead branches through the ditch as often as necessary. Pits should be sunk in the bottom of the ditch at short intervals in which the insects will accumulate, where they can easily be buried. Where it is possible to flood the ditches with water, the water may be covered with a film of coal oil, and the insects can be rapidly and certainly destroyed by being driven into the ditches.

The hopperdozer, much used in the northwest to destroy the nymphs, consists of a shallow receptacle of any convenient size, furnished with high back and sides, mounted either on wheels or runners. Large pans are provided with transverse partitions which prevent slopping of the water and oil when the machine catches a jar. The pans are filled with water and coal oil or gas tar, and are then pushed by hand or horse power over the infested fields, a set of shafts and handles being so arranged that the front edge of the pan can be elevated or depressed at will to adjust it to the jumps of the nymphs. A suggested form for operation by hand power is made of ordinary sheet iron eight feet long, eleven inches wide at the bottom, and turned up a foot high in the back, and an inch high in front. A runner extending some distance behind is placed at each end and a cord is attached to each front corner. This may be drawn by two boys. With more hands, several dozers may be placed end to end in a row, one man holding the cords of each pair of continuous ends, and thus the work may be done rapidly and well.

WHEAT INSECTS.

MARCH--APRIL.

The WHEAT JOINT WORM, *Isosoma tritici*, is carried over in the straw or stubble of the preceding year. In sections where winter wheat is grown, if care was not taken the preceding fall to sow as far as possible from the infested stubble fields, the best remedy where it can be applied is to burn the stubble. Where the wheat was sown as a nurse crop for grass and, therefore, the stubble cannot be burned, it may be worth while to rake over the field with a hayrake

so as to remove part of the stubble, which may be burned. Badly infested straw remaining unused should be burned by the last of March so as to prevent any adults escaping to growing fields. Straw that has been well tramped by live stock and has been heated several weeks by passing through the manure heap, is probably safe enough to scatter over fields in spring, especially if they are distant from the wheat field; but comparatively fresh straw that has undergone but little change since leaving the stack, although it has passed through the manure heap, is too questionable to spread on lands that are near wheat fields. Such green manure, if containing larvae or pupae, should be left in the manure heap for a longer time.

If young wheat looks very sickly in spring, examine it carefully for indications of the HESSIAN FLY, *Mayetiola destructor*. The shining, brownish pupae, closely resembling flaxseeds, may be found beneath the culms at the bases of the plants. If they are very numerous in April, and a large percentage of the plants died during the winter from injury inflicted by them, it is sometimes best to plow the infested field under deeply and plant to some other crop.

CORN INSECTS.

APRIL--MAY.

The WESTERN CORN ROOT WORM, *Diabrotica longicornis*, is readily controlled by rotation of crops. Do not follow corn with corn, and do not plant corn in fields where the adult beetles were observed in exceptional abundance on weeds and clover, the preceding year. The beetle is about one-fifth of an inch in length and of a uniform pale-green or grass-green color. A well fertilized soil and thorough cultivation will do much to enable plants to outgrow damage to the corn roots.

Preventive measures for the SOUTHERN CORN ROOT WORM, *Diabrotica 12-punctata*, are the same as for the preceding species. Late planting also helps protect against this species. Planting a sufficiently large number of grains in a hill to feed the larvae and leave a good stand besides is sometimes practiced. Most grains and vegetables except beans and cucurbits, may be rotated with corn in badly infested districts. The beetle is generally mistaken for a ladybug, being of similar appearance, a trifle over one-fourth inch long, yellowish green in color, the wing covers marked with 12 black spots.

The SEED CORN MAGGOT, *Pegomya fusciceps* Zett, is more important as a vegetable insect than as a corn pest. (See page 80.) In case it becomes destructive to corn, rotate the crops and use an excess of seed.

The CORN ROOT APHIS, *Aphis maidi-radicus*, may be greatly reduced in numbers by frequently stirring the ground between plowing and planting. This may be accomplished with a disk-harrow or a cultivator. This operation destroys many of the ants which foster the lice, by breaking up their nests, and kills many of the young of both ants and lice. Fertilizing well with barnyard manure also does much to fortify the corn against damage by the lice. Dr. Forbes, of the Illinois Station, reports promising results by treating the seed corn with a mixture of oil of lemon and wood alcohol. One gallon of wood alcohol is combined with one pint of oil of lemon, and three fluid ounces or six tablespoonsful of this mixture is sprinkled into each gallon of seed before planting. The corn is thoroughly stirred while being sprinkled to insure an equal distribution of the fluid and to make sure that each kernel of corn has its proper share. The odor of this mixture persists for weeks after the corn is buried, and owing to its repelling powers the cornfield ant will not enter corn hills until all odor has gone; consequently no aphis eggs are carried into the hills. Cost of materials is not over 10 cents per acre.

CUTWORMS may be destroyed with the poisoned bran bait. (See page 78.) This treatment has been tested on a large scale in the Canadian provinces and proved to be practical and successful. Cost, including labor of making the application, should not exceed one dollar per acre.

The CORN ROOT WEB WORM, *Crambus caliginosellus*, and allied species, often damage young corn by burrowing into the base of the stalks. The larvae live in fine, loose, silken webs or cases, about an inch below the surface of the ground. These insects are normally grass feeders and rarely injure corn to a serious extent, except where planted on sod land. If there is reason to suppose them abundant on new land, plant to potatoes, buckwheat or some other crop than corn.

CLOVER INSECTS.

APRIL--MAY.

The larva of the CLOVER SEED MIDGE, *Cecidomyia leguminicola*, a small, reddish maggot which feeds in the florets, is often a cause of failure to mature a crop of seed. One method of dodging its effects is to pasture the clover during the spring months until about the middle of June, when the live stock is removed and a late crop of seed is generally obtained. There are two broods of the midge, one appearing about the middle of June, the second and smaller one in July and August. If the plants are kept eaten down in spring so that no June brood matures, because of the lack of blossoms on which to feed, the second or late brood will do very little damage.

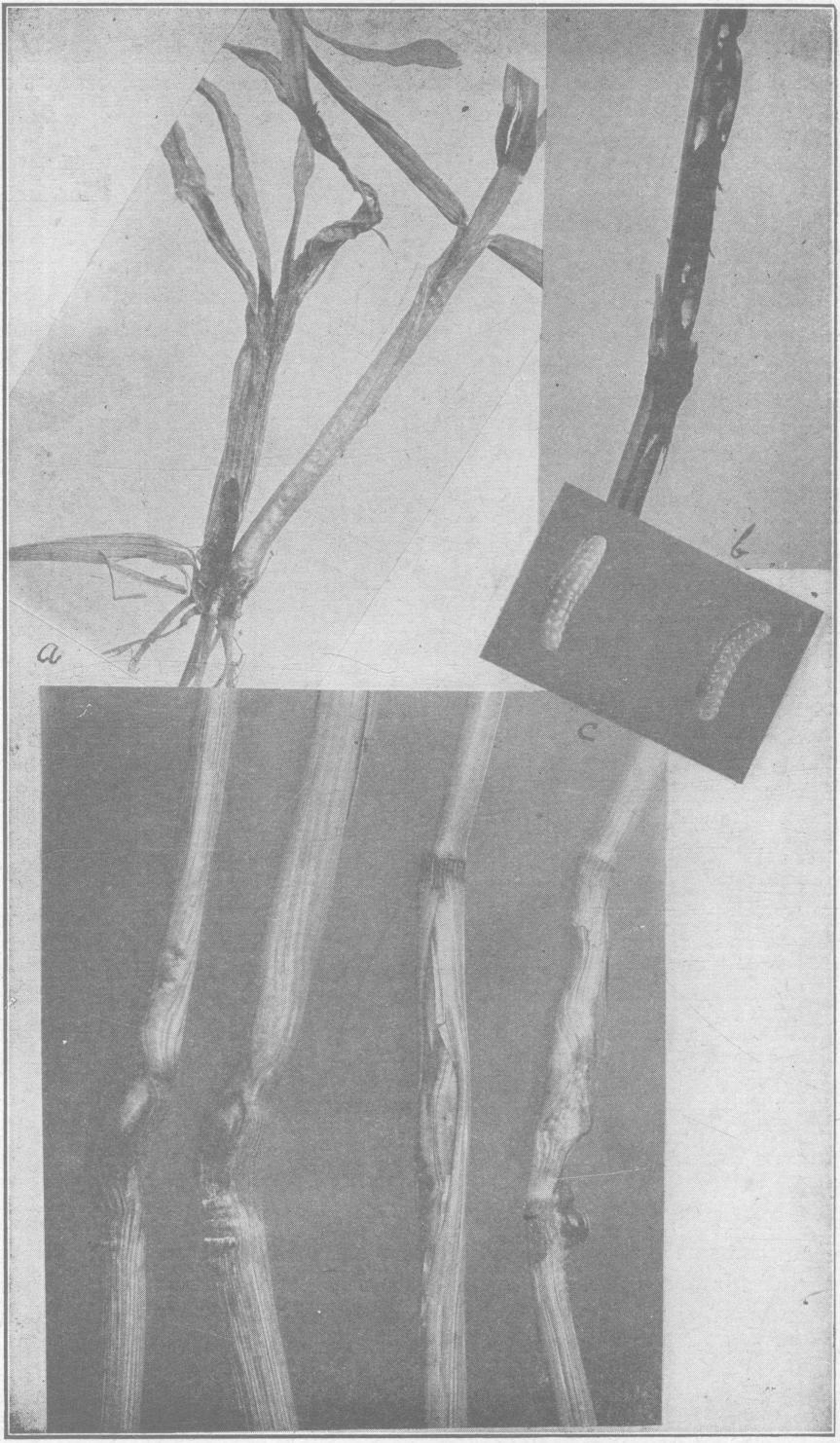
EXPLANATION OF PLATE III.

a The Hessian fly. In flaxseed stage at base of stalk.
Negative by Houser

b Joint worm in wheat straw.
Photo by Goodwin.

c Joint worm larvae, enlarged.
Photo by Goodwin.

d Straws injured by joint worm showing enlargement and woody portions just above the joints.
Photo by Goodwin.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The CLOVER SEED CATERPILLAR, *Grapholitha interstinctana*, also, feeds upon the florets, when they appear, as well as in the crowns of the plants near the earth in spring. Pasturage will likewise tend to diminish injury by this pest in spring.

The yellowish green, slug-like larvae of the CLOVER LEAF WEEVIL *Phytonomous punctatus*, begin feeding on the leaves of clover very early in spring and continue until they attain full growth in May and June. Beginning at the edge of a leaf the larva eats out a segment bounded by a regularly curved line. Sometimes smaller areas are eaten from the interior parts of the leaflets. When full grown the larvae construct very delicate cocoons of a greenish-yellow color on the surface of the ground. A fungous disease does much to control this species. The larvae in great numbers, just about the time they are grown, curve themselves around a spear of grass or over the edge of a leaflet and die, becoming covered with a white mold and later turning to a jelly-like consistency, eventually drying out to a small black mass entirely unrecognizable to the unfamiliar eye.

TOBACCO INSECTS.

APRIL--MAY.

CUTWORMS: Grass or clover sod that is to be planted to tobacco generally needs special attention to destroy cutworms before the tobacco is set out. Thorough cultivation in the spring, before planting, so as to deprive the worms of food, will help. If the poisoned bran mash (See page 78) is scattered over the land, a tablespoonful near each hill several days before the crop is planted, the majority of the worms will be killed before they have the opportunity of doing harm.

TOBACCO STALK WORM or SOD WEB WORM: This insect, *Crambus caliginosellus*, commonly known as the CORN ROOT WEB WORM burrows into the stalks of newly set tobacco, sometimes destroying as many as three successive plantings of tobacco over the same ground. Where these worms are known to abound, do not plant tobacco after grass or timothy. Instead, follow with wheat and then clover before tobacco. If tobacco must follow grass at once, plow as early as possible, then roll and harrow at frequent intervals to starve out the worms before planting, which should be delayed as long as the season will permit.

TOBACCO FLEA BEETLE: This very small beetle, *Epitrix parvula* Fab., is of a light brown color, with a dark band transversely across the wing covers. It has the power of leaping like a flea. When numerous, they eat the leaves full of very small holes. Spray with weak Bordeaux mixture combined with arsenate of lead.

ORCHARD TREATMENT.

APPLE INSECTS.

MARCH.

About the first of March in ordinary seasons, or a trifle earlier in forward ones, the female moths of the SPRING CANKER WORM, *Paleacrita vernata*, issue from the ground and crawl up the trees to deposit their eggs. These females are wingless and may be intercepted in their ascent of the trunks and destroyed by tens of thousands by placing a sticky girdle around the trees from one to three feet above the ground. Bands of burlap painted over with coal tar, or printers ink, will serve the purpose, if painting is renewed often enough to keep the bands sticky. Tree tanglefoot, made by the O. & W. Thum Co., Grand Rapids, Mich., is a preparation designed especially for banding trees, and is applied directly to the bark with a brush. It remains sticky for months. Or strips of wire screening, four inches wide and of sufficient length to overlap a few inches after encircling the tree, may be used. A girdle of cotton batting is put around the tree, and the bottom of the band of wire netting is then tied tightly over the cotton ring by means of baling wire or stout cord. The top of the wire collar is now bent down over its fastening so as to give a downward and outward flare. But few of the moths will succeed in passing this collar. Orchards that are regularly sprayed for codling worm rarely, if ever, need banding. Directions for spraying for canker worm are given in operations for April.

SAN JOSE SCALE, *Aspidiotus perniciosus*, may be treated with the lime-sulphur spray up to the time the buds are unfolding in March and April. It is often impracticable to make an application earlier than late March because of freezing weather. In our practice, thus far, we have secured somewhat better results with spring applications than with those given at other periods. Sometimes it happens that the insect is present in an orchard but remains undiscovered or unrecognized until after the trees are in full leaf. In such case, probably the best course to pursue is to paint the trunks and as much as possible of the larger limbs with lime-sulphur spray, using a brush. The tops may be sprayed in June, at hatching time, with soluble oil or kerosene emulsion. By this means the trees may be enabled to withstand injuries which might otherwise prove fatal, until the following winter and spring, when they can be properly sprayed.

APRIL.

The BUD WORM, *Tmetocera ocellana*, enters the buds of apples and other fruit trees in early spring, just when they begin to swell and open, frequently cutting off terminal growth and injuring the

fruit crop by destruction of the bloom buds. Later, the caterpillars tie the leaves together, forming conspicuous nests. As soon as the leaf tips appear in the buds, spray with an arsenical. Spray again in about a week or ten days, just before the blossoms open. This second spraying will serve as the first for canker-worm. Spray a third time just after the blossoms fall. This last spraying, which usually comes in May, will make the second for canker worms and the first for codling moth. The budworm will not appear in numbers demanding treatment, if for any reason the trees were sprayed in winter or spring with the lime-sulfur wash.

The eggs of the SPRING CANKER WORM, *Paleacrita vernata*, hatch some time in April in ordinary seasons and are most readily killed by spraying, if the application is made while they are young. Spray with arsenate of lead or Paris green in Bordeaux mixture, as soon as the leaves are expanded. The second spraying coincides with the first for codling moth and should be given just after the petals fall. Where spraying for codling worm is regularly practiced, it is usually unnecessary to give any attention to canker worms. In case the FALL CANKER WORM, *Alsophila pometaria*, is present, and banding in the fall was neglected, spraying as for the spring canker worm is the right procedure. The eggs of the fall insect hatch coincidentally with those of its spring relative. The larvae of both species are loopers or measuring worms, greenish or brownish in color, with pale or yellowish stripes. When grown, the caterpillars swing to the ground by means of silken threads and, while thus suspended in air, if numerous, are a great annoyance to persons obliged to pass beneath the trees. When disturbed, they lower and raise themselves in similar fashion.

The PISTOL CASE BEARER, *Coleophora malivorella*, and the CIGAR CASE BEARER, *Coleophora fletcherella*, attack the buds as soon as they begin to open and often burrow into them and eat out their entire contents, leaving only empty shells. At this time, the cases are about an eighth of an inch long, and are pistol-shaped and colored like the bark with the first species, more flattened and lighter colored with the second. Later, the caterpillars eat holes into the young fruit and make incisions in the skin of the leaves, through which they protrude their bodies from their cases and work like leaf miners, consuming the pulp between the two skins, leaving only the skeleton of the leaves. They do not leave their cases while feeding, but protrude enough of their bodies through the cut they have made in the epidermis to enable them to mine out an irregular area around the opening. They construct new and larger cases in the latter part of May and continue feeding until the latter part of June when pupation occurs. Treatment is exactly the same as for the bud-worm, both as to time of application and materials to use.

The LIME TREE WINTER MOTH, *Erannis tiliaria* Harris, is quite like the canker-worm moth in habits. The eggs are deposited by the wingless females in October or November and hatch in early spring, or the moths may not issue from the ground and ascend the trees until spring. The larvae are loopers, or measuring worms, somewhat longer than canker-worms. The head of this caterpillar is dull red with a v-shaped mark on the front; the body is yellow above with many longitudinal black lines; the under side is paler. When full grown, about the middle of June, it is about one and one-quarter inch long. Remedies are the same in all respects as for canker worms.

The stem mothers of the APPLE PLANT LICE, or APHIDS, *Aphis fitchii*, *A. pomi* and *A. sorbi*, hatch in late March and during April and early May from shining black eggs laid on the bark and about the buds in the preceding Autumn. The earliest specimens of *A. fitchii* may be expected in late March and early April in southern Ohio, and one or two weeks later in the north half of the State. About the middle of April, the green colonies of young lice may be found clustering on the swelling terminal buds. After passing through several generations, this species migrates during the latter part of May from apple to other host plants and is not again found on apple until fall. *Aphis pomi*, very similar in appearance to *A. fitchii*, appears about two weeks later than the latter species, and is not found on the unopened buds, but, again unlike *A. fitchii*, curls the leaves in characteristic fashion and remains upon apple throughout the season.

A. sorbi, a species containing blackish, reddish, yellowish and brownish representatives among its different forms, appears in late April or a little later; and, during the first half of May, the stem mothers may be found depositing their small brownish young among the green colonies of *A. fitchii*. This species curls the leaves worse than *A. pomi* and like *A. fitchii* is a migrant from apple to other plants, but not until spring is over.

The best treatment for aphids is very thorough spraying with tobacco decoction, kerosene emulsion or whale oil soap. Some of the commercial preparations of tobacco extract are excellent for this purpose. A home-made extract of tobacco is made by boiling one pound of tobacco stems, or dust, for about an hour in one or two gallons of water. When boiling is finished, add water to make two gallons of liquid for each pound of tobacco used; the efficiency of the spray will be increased by adding one or two pounds of whale oil soap to every fifty gallons of decoction. Kerosene emulsion may be

used diluted with five parts of water. Whale oil soap, one pound dissolved in four gallons of water, is also quite effective. If leaves are badly curled by the lice, the branches should be bent down and dipped into the liquid.

Some individuals of the WOOLLY PLANT LOUSE, *Schizoneura lanigera*, live through the winter in sheltered positions on the bark as well as on the roots, and both aerial and root forms begin reproduction in the spring. The eggs also hatch at about the same time as those of other apple aphids. This louse is almost wholly confined to the roots and branches. On the roots it produces masses of wart-like swellings and the life of the tree is often endangered. The aerial form is covered with white or bluish-white cottony matter, giving badly infested branches the appearance of being over-run with a luxuriant mold. The treatment recommended for other aphids is efficient against the aerial form. The lime-sulfur wash, when used in winter or in early spring against other insects, will usually render other measures against the aerial form unnecessary. After the leaves appear lime-sulfur can be applied to the trunks and larger limbs by means of a brush and results will be excellent. The underground form may be controlled, if the trees are young, by mixing tobacco dust liberally with the soil in contact with the roots. A top dressing of wood ashes is also advantageous. After trees have become old it is hard to exterminate the lice from the roots. In case young trees to be planted out are infested when they come from the nursey, the roots can be freed from the lice by puddling them in mud impregnated with tobacco. Dig a good sized hole in the ground and in it mix enough loose earth, tobacco dust and water to make a fairly thick slush, or mud, which will readily adhere to the roots. These are immersed in the mud before the trees are planted.

The larva of the LEAF CRUMPLER, *Mineola indigenella*, rouses into activity with the swelling of the buds, cuts loose the silken threads which have anchored its case during the winter, and this is now dragged to suitable feeding grounds among the opening buds and young leaves. The new leaves are drawn toward the mouth of the case, near which they are fastened by silken threads. The worms can now feed in comparative safety without leaving their homes. The deep reddish-brown color possessed by the larva in early spring gives way to a pronounced green as the worm approaches maturity, about the end of May. Also its case has become shaped like a crooked, wavy horn, brownish or blackish in color, closely resembling a piece of bird dung. The interior is lined with silk, and the occupant clings to its house most tenaciously when an attempt is made to

remove it. Sometime in late May or early June it transforms within the case to a brown chrysalis. Any ordinary infestation can be controlled by winter treatment. (See Winter Manual p. 17). When present in extreme numbers, the insect should be treated like the bud worm.

Sometimes the expanding buds of apple and other fruit trees are eaten into and destroyed, yet no destructive agent is in evidence to account for the damage. Some parts of the tree fail to leaf out, or the young leaves on an entire branch suddenly disappear. Some of the blossoms are found to have a hole cut through the side of the calyx and the ovary consumed. Such damage is usually indicative of the work of CLIMBING CUTWORMS which feed at night. Several different species work such injury. Banding the trees as for canker worms, with sticky materials, cotton batting or tin collars (See p. 14, Winter Manual) is perhaps the most reliable measure. Poisoned bran mash (See page 78) used in conjunction with banding is very effective. Where early spraying is done for the bud-worms and case-bearers or canker-worms, probably no other measure will be needed.

As soon as the apple leaves begin to unfold, a brownish or yellowish-brown moth with flattened wings which give the insect a bell-shaped outline when at rest, lays its eggs upon them, and the young caterpillars, upon hatching, at once begin to roll the yonng leaves into cylinder form and within this roll they live and feed. When disturbed, they quickly slip out of their retreat and try to escape danger by letting themselves to the ground by means of a silken thread. Besides eating the leaves, they gnaw the skin of the young fruit, leaving scars, which later become brown and rusty. This insect is the OBLIQUE BANDED LEAF ROLLER, *Archips rosaceana* Harris. The larvae work during the entire spring, maturity not being attained until some time in late June or early July. The second and third sprayings made for bud-worms and case-bearers will control this insect.

Another leaf-folder which commences work with the opening of the leaves is *Acleris minuta* Rob., commonly known as the LESSER APPLE LEAF FOLDER. The eggs for the spring brood are laid by a small slate-gray moth and hatch into small green worms, having pale brown or yellowish heads with white markings. The opposite edges of the young leaves are drawn together upwards and fastened with a silken web, thus forming a roofed chamber within which the caterpillar lives. Like all of its family, when alarmed, it deftly lowers itself to the ground by means of a silken thread. It is controlled by the same remedies as the preceding species.

FXPLANATION OF PLATE IV.

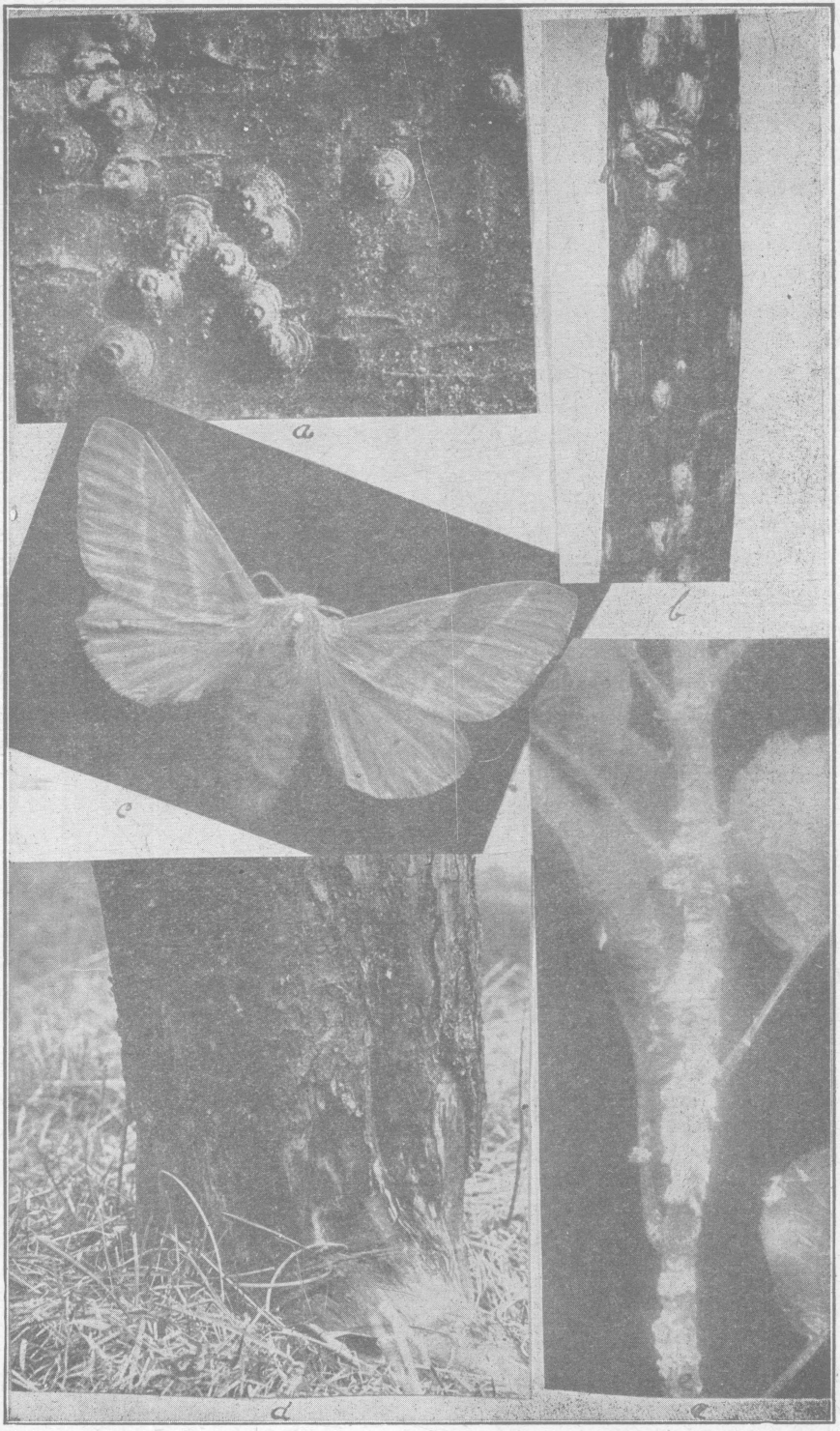
a San Jose scale, enlarged.
Negative by Houser

b Scurfy scale.
Negative by Houser.

c Adult apple tree tent caterpillar, female.
Negative by Houser.

d Injury to twelve year old apple tree by wooly aphis.
Photo by Goodwin.

e Wooly aphis on young limb of an apple.
Negative by Houser.


a
b
c
d
e

MAY.

The eggs of the APPLE TREE TENT CATERPILLAR, *Malacosoma americana*, hatch in April or early May soon after the leaves begin to unfold. As soon as weather conditions are propitious, the caterpillars extend a web across the nearest fork of the twig upon which they were hatched. Later, other layers of silk are added, attachment being made to neighboring twigs and sufficient space left between the layers for the caterpillars to pass. The entrances to the nest are near the extremities or angles of the web and into this shelter the worms retreat for the night, also in stormy weather and when not feeding. Exit to feed usually occurs once in the forenoon and once in the afternoon. The blackish caterpillar has a white stripe down the back and on each side of this central stripe there are a number of short, irregular, longitudinal yellow lines. On the sides are paler lines with spots and streaks of pale blue. The under side of body is pale blackish. In the early morning hours or late in the evening, by means of a ladder, it is possible to gather the web into the gloved hand and crush the whole nest of caterpillars with one squeeze. The same end can be accomplished by tying a rag around a pole and rotating it within the net to collect the web. Holding a lighted torch beneath the nest is also a convenient means of destroying them. Special care must be taken not to scorch the bark and thus kill important branches when using the torch. Orchards that are regularly sprayed with arsenicals for the canker worm, codling moth, etc., are seldom troubled with tent caterpillars.

The eggs of the FOREST TENT CATERPILLAR, *Malacosoma disstria*, also hatch with the opening of the buds. The only web made by this species is a slight one, constructed by the caterpillars while very young, against the side of the trunk or limb on which the nest is located, and this is so inconspicuous that it is usually unnoticed. The caterpillars often march in double column in passing from one point to another. During the evening, and also in the early morning, they are usually found collected in large bunches on the trunks and larger branches of trees. When full grown, they are of a pale bluish color, dotted and pointed all over with black. Instead of the white stripe down the back, possessed by the apple tree tent caterpillar, is a row of ten or eleven oval or diamond shaped white spots. On the sides are some more or less broken pale yellow stripes. When the colony is collected into a bunch, the mass may be burned with a brisk kerosene torch, sprayed with kerosene, or crushed with a club. When collected on a branch to rest or to feed, if the limb is dealt a smart blow with a padded wooden mallet, the worms will suddenly loosen their hold and drop to the ground as if they were

shot; by spreading a sheet beneath the tree to catch them as they fall, they may be swept up and emptied into a pail containing water and kerosene. Of limited application is the dislodgment of the worms by means of hydrant water conducted through a hose. When the worms are dislodged without being destroyed, trees liable to their attacks should be protected against their ascent by means of sticky bands, such as are used against the female canker worm moth. Similar bands should be used to protect orchards against threatened invasion from the forest. The remarks regarding the use of arsenicals against the preceding species, apply here.

During the months of March, April and May two or three species of moths (*Xylina* spp.) closely resembling the more common types of cutworm moths are nocturnal frequenters of sugar camps and come readily to sweetened baits. These lay the eggs which hatch a little later, and grow into large, light yellowish or apple green caterpillars, with a narrow cream colored stripe down the middle of their backs, a wide cream colored stripe along each of their sides, and many similarly colored mottlings or spots which sometimes form quite distinct stripes along the bodies above the broad lateral stripes. These worms feed upon the foliage of the apple and of various forest trees. They are known as FRUIT WORMS from their habit of eating into young fruit. The cavity eaten out by one of them often exceeds in bulk the remnant of the fruit which is left. A single caterpillar has been known to destroy six out of eight quinces that were to be found on a tree. Their favorite fruit is the apple, but nearly all of the orchard and small fruits are subject to attack. Before the fruit is set, the caterpillars feed on the leaves and buds, hence, spraying before blossoming time with an arsenical spray, would seem to promise a certain degree of immunity from later damage. After fruiting begins, these worms can hardly be controlled by poisons and the only remedy that has been suggested is to take advantage of their habit of dropping to the ground when they are suddenly jarred, and fight them with the jarring method as if they were curculios. On young trees, the jarring method works very well, but is hardly practicable on old, large trees.

The CODLING MOTH, *Carpocapsa pomonella*, appears about the date the blossoms begin to fall and lays its eggs on the skin of the young fruit, on the leaves, and occasionally on the twigs. These eggs hatch in about a week and 80 percent, or more, of the young worms enter the apples at the blossom end. Each caterpillar remains for several days in the calyx cup, after which it eats its way to the core. It becomes full grown in early summer. A spraying with arsenate of lead, or other similar poison, should be given

EXPLANATION OF PLATE V.

FIG. 1 What will happen next fall if the apples are properly sprayed. Picked harvest of Baldwin tree sprayed three times.

Photo by Goodwin

FIG. 2 What will happen next fall if the apples are not sprayed. Picked harvest of Baldwin tree, same season in same orchard, not sprayed.

Photo by Goodwin.

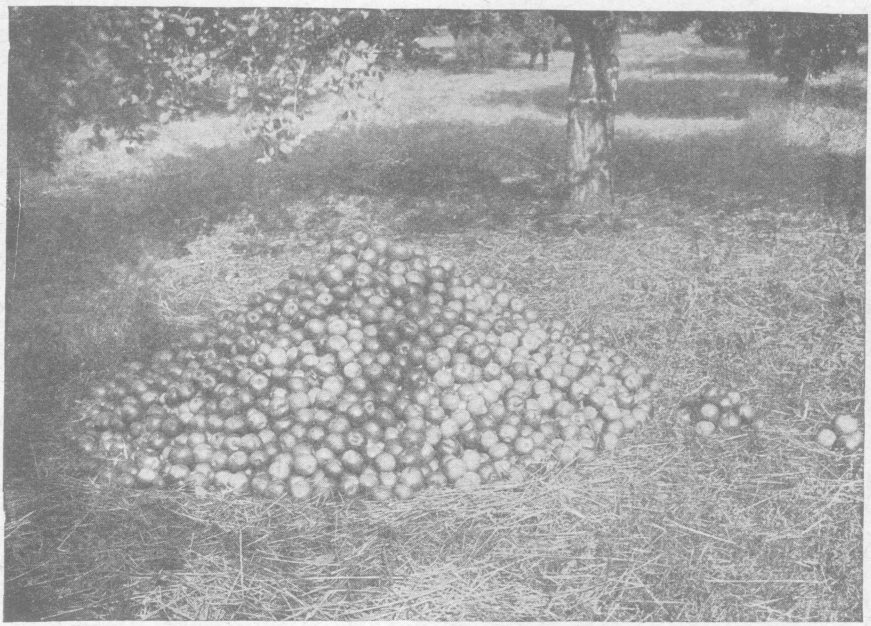


FIG. 1. Sprayed three times.

Picked harvest.

Sonnd, 3152
99.37%

Wormy, 15
.47%

Damaged by Curculio, 5
.15%

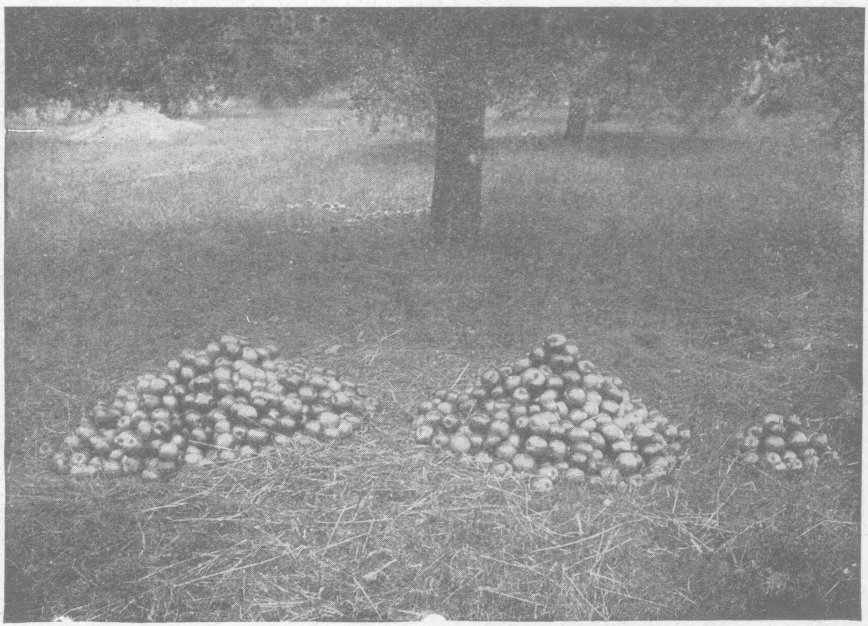


FIG. 2. Not sprayed.

Picked harvest.

Sound, 773
59.83%

Wormy, 461
35.68%

Damaged by Curculio, 58
6.98%

before the apples have become heavy enough to turn blossom-end downward. Since the mouth of the calyx cup should be turned upward to receive the spray, the application is best made immediately after the petals fall. A second spraying should be made about a week or ten days after the first.

About the middle of May the PLUM CURCULIO, *Conotrachelus nenuphar*, a brown chunky snout-beetle, with black and gray mottlings and four warts on the wing covers, begins to issue from its hibernating quarters and probably feeds sparingly on the leaves until the fruit is set, which is at once attacked. An excavation is made into the pulp, an egg is laid in the cavity, then a crescent-shaped flap is cut around the puncture. The small whitish grub tunnels through the pulp, checking growth, inciting decay, and finally causing the apple to fall. In many orchards this insect does about as much damage as the codling moth. One spraying with an arsenical before blossoming time, a second while the blossoms are falling or as soon as they have fallen, and a third a week or ten days after the second, furnishes the most satisfactory treatment. Since all three of these sprayings have been recommended for other insects, no extra labor is involved in fighting this pest.

About the middle of May appears the APPLE CURCULIO, *Anthonomus quadrigibbus*. This is a snout-beetle like the plum curculio but is slightly smaller. It is dull brown in color and the back is more convex than that of the plum curculio. On the posterior slope of the wing covers are four prominent warts or projections, two on each cover. It commonly infests the thorn apple or wild haws and the native crab-apple. In a puncture made into the pulp with the bill an egg is laid and the outside opening is plugged with a viscid excrement. Later, the puncture shows as a small black spot, located in a depression or hollowed-out basin, covered by stunted growth of the fruit in proximity to the burrows. Remedy, same as for plum curculio.

The ROUND HEADED APPLE TREE BORER, *Saperda candida*, is under discolored bark, usually near the base of the tree. The bark over the burrow is apt to crack in spring, through which a reddish wood-dust sifts to the ground. Open the burrow and destroy the grub with a knife or probe. Where serious injury would be inflicted on the tree by cutting into the burrow, inject carbon bisulphide or chloroform by means of a spring-bottom oil can and close the opening at once with clay, mud or wax, to cofine the fumes. Since the eggs are laid in June, soon after the middle of May give the trunks and larger limbs a heavy coat of whitewash. A little Portland cement added to the whitewash would probably add to its efficiency in preventing the ingress of newly-hatched larvae. The carbolized soap

spray recommended in the Winter Manual, as protection against the Fruit-tree Bark Borer, is used by some instead of whitewash. Others take soft or whale oil soap and reduce it to the constituency of a thick paint by adding a strong solution of washing soda in water and a pint of crude carbolic acid to every 8 or 10 gallons of the mixture. This is applied to the entire surface of the bark liable to attack, and, if exposed to several hours of warm sunshine, forms a tenacious coating resistant to rain. The odor repels the females, and such young as hatch perish in trying to penetrate through the greasy mixture.

The FLAT HEADED BORER, *Chrysobothris femorata*, exhibits the same external symptoms of its presence as the round-headed species, but is located higher up the trunk and is sometimes found on the higher branches. Remedies, the same as for the preceding species.

The FRUIT TREE BARK BORER or SHOT HOLE BORER, *Scolytus rugulosus*, becomes especially active with the opening of spring and soon commences to migrate from infested trees to uninfested ones that have, from any cause, become weakened and unhealthy. Badly attacked trees should be cut down and burned, since they cannot recover, and are a standing menace to all others near them. If a tree is not badly attacked, it may be possible to save it, first by removal of the weakening cause which is almost certainly present, and second, by generously fertilizing it. Cover the trunk and larger limbs with whitewash to which some Portland cement and white arsenic or Paris green have been added; or, use instead the carbolized whale oil soap recommended in the Winter Manual, page 19. Since vigorous, healthy trees will not sustain the borers very well, it is important to bring all weakened trees back to a condition of thrift by means of care, fertilizer, and cultivation before they are attacked; also use the whitewash on them to prevent egg-laying and the ingress of young larvae hatching on the bark.

The SCURFY SCALE, *Chionaspis furfurus*, remains in the egg stage until about the middle of May, possibly a week earlier in the southern or a week later in the northern portion of the State, when the purplish young issue from beneath the elongated, grayish or whitish scales. The eggs, from 10 to 75 or more in number, before hatching, are purple, like the young. Treatment should be exactly as for the oyster shell scale, only it should be given one or two weeks earlier.

The OYSTER SHELL SCALE, *Lepidosaphes ulmi*, is in the egg stage until about the last week in May or the first week in June, the whitish eggs from 25 to 100 in number being concealed beneath the brownish scale, which is shaped like an oyster shell. The eggs turn

yellowish before hatching. If weather is cool at hatching time, the young remain sheltered beneath the scales until warm weather supervenes. Then they emerge as whitish, crawling specks and settle, preferably near the buds, but, in case of bad infestation, over the young wood, the larger limbs, and finally on the trunk wherever the bark is smooth enough to give them lodgement. As soon as the young are observed crawling over the bark in numbers, which in southern Ohio will probably be during the latter part of May, spray thoroughly with whale oil soap, one pound dissolved in five gallons of water, or with kerosene emulsion, one part of emulsion to nine parts of water. At this period, two sprayings ten days apart should practically control this insect. In central or northern Ohio, the hatching period, or at least a portion of it, is thrown over into June, the summer period.

GENERAL PROGRAM OF TREATMENT FOR THE APPLE. *

When to spray	For what to spray	With what to spray	Remarks
(Special) Late February or in March.	Canker worms.	Band trees with tree tanglefoot, cotton, printer's ink, or wire gauze collars.	Useful in old orchards which have not been regularly sprayed. Gives quicker results than spraying. Not necessary when spraying is regularly practiced.
(Special) Early spring before buds break.	San Jose scale, oyster-shell scale, scurfy scale.	Lime-sulfur wash or soluble oil.	Not necessary unless scale is present.
(Special) Just as buds are swelling to break.	Bud worms and case-worms.	Arsenate of lead or other arsenical.	Not needed unless the insects are present.
(Special) Just as the green tips of the first leaves burst from the buds.	Bud-worms, case bearers, canker worms, tent caterpillars, leaf rollers, and other leaf-eating insects. Also for scab, canker and leaf spot.	Arsenate of lead or other arsenical in Bordeaux mixture.	Same as above.
* 1 Just before the blossoms open.	For curculio, leaf-eating insects, scab and leaf spot.	Same as above.	Generally considered the most important application for the control of scab.
2 Just after the blossoms fall.	For insects and diseases listed under 1 and codling worm.	Same as above.	The most important application for the control of codling worm and nearly as important as 1 for scab.
3 Ten to fifteen days after 2.	For insects and diseases listed under 2 and bitter rot.	Same as above.	Best results with codling worm will be obtained if this spraying is made about ten days after 2.
(Special) Late May or early June.	Scurfy scale and oyster shell scale.	Kerosene emulsion, whale oil soap or soluble oil.	Spray when young scales are observed crawling in numbers over the bark.
4 About second to last week in July.	For scab, bitter rot, sooty blotch, fly speck, second brood of codling worm and other insects and diseases.	Arsenate of lead or other arsenical in Bordeaux mixture.	Often important against codling worm and fungous diseases. Arsenate of lead is less likely to burn fruit stems and thereby cause falling than other arsenicals.

*The numbered treatments are necessary and should be given every year at the times indicated. Special treatments are not necessary except for the pests and diseases mentioned.

PEAR INSECTS.

MARCH--APRIL.

Reference has already been made in the Winter Manual to the PEAR PYSLLA, *Pyslla pyricola*, and PEAR LEAF BLISTER MITE, *Eriophyes pyri*. If the lime-sulfur wash or kerosene emulsion was not used for these during the winter period, by all means make the application while the buds are swelling and before they have opened, if these pests were present during the preceding summer.

The following pests attacking apple, also feed upon the pear. Reference should be made to the apple section for treatment:

SAN JOSE SCALE, *Aspidiotus perniciosus*. See page 39.
SCURFY SCALE, *Chionaspis furfurus*. See page 51.
OYSTER SHELL SCALE, *Lepidosaphes ulmi*. See page 51.
SPRING CANKER WORM, *Paleacrita vernata*. See pages 39, 40.
EYE SPOTTED BUD MOTH, *Tmetocera ocellana*. See page 39.
PISTOL CASE BEARER, *Coleophora malivorella*. See page 40.
CIGAR CASE BEARER, *Coleophora fletcherella*. See page 40.
APHIDS. See page 41.
LEAF CRUMPLER, *Mineola indigenella*. See page 42.
CLIMBING CUTWORMS. See page 43.
OBLIQUE BANDED LEAF ROLLER, *Archips rosaceana*. See page 43.
LESSER APPLE LEAF FOLDER, *Acleris minuta*. See page 43.

MAY.

APPLE TENT CATERPILLAR, *Malacosoma americana*. See page 46.
CODLING MOTH, *Carpocapsa pomonella*. See page 47.
PLUM CURCULIO, *Conotrachelus nenuphar*. See page 50.

The eggs of the PEAR PSYLLA hatch in May and the young are, at this time, about one-sixteenth of an inch long, yellow in color, afterwards becoming marked with black and red. They are sucking insects and the drain they make upon the vitality of the tree by drawing juices from the leaves is shown early in the season by a drooping of the young growth and considerable dropping both of fruit and foliage. The leaves become covered with a coating of honey dew in which a black sooty mold will flourish later in the season. Flies, wasps and ants swarm about the tree, attracted by the honey dew, and thus give notice of the unhealthful condition that exists. The young insects can be found with sharp eyes or with a magnifying glass, resting in and about the axils of the leaves, immersed in honey dew. While the insects are immature and cannot fly, they may be

EXPLANATION OF PLATE VI.

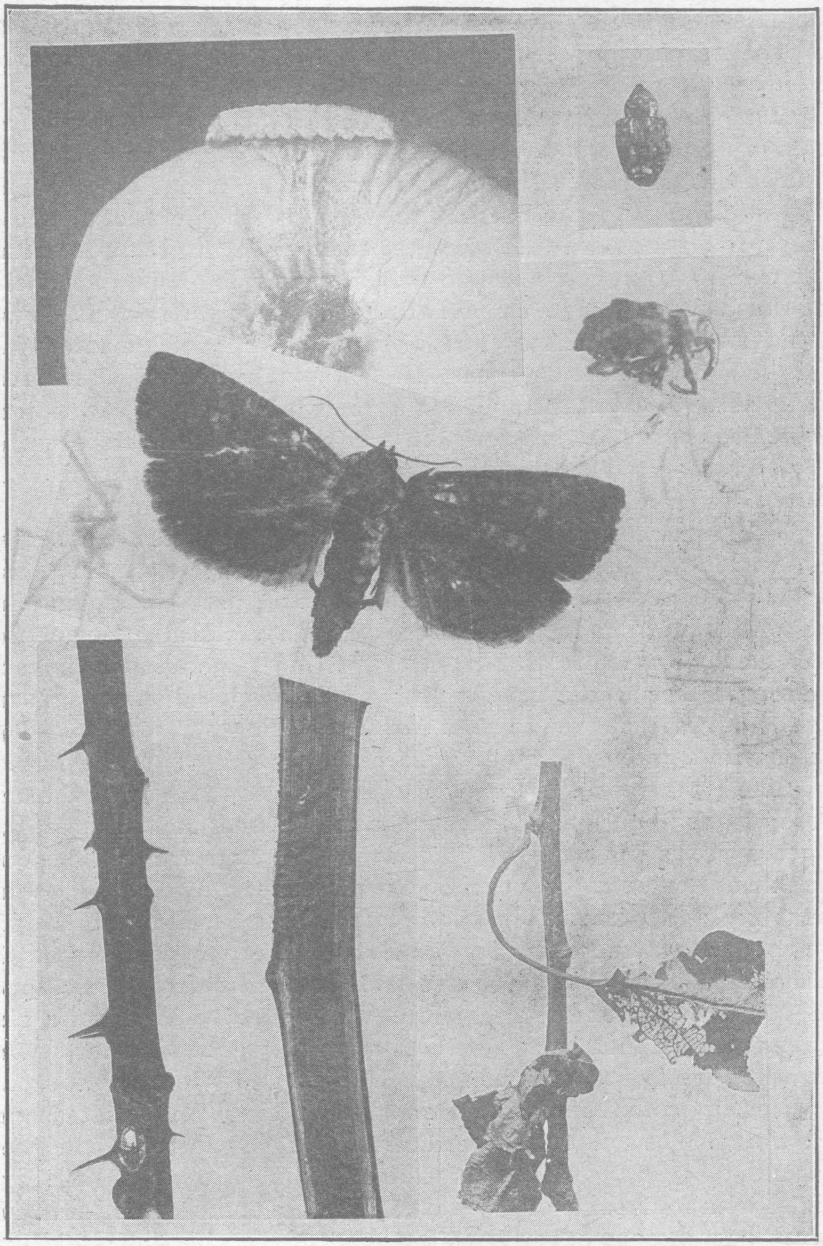
a Codling moth larva on an apple, enlarged.
Negative by Houser.

b Adult codling moth, enlarged.
Photo by Goodwin.

c Tree cricket injury to raspberry canes.
Negative by Houser.

d Apple leaf crumpler, winter home.
Negative by Houser.

e and f Dorsal and side views of a plum curculio.
Photo by Goodwin.



destroyed by spraying thoroughly with kerosene emulsion, one part of emulsion in twenty-five parts of water. Winter treatment is the more satisfactory method, and the grower should endeavor to avoid the necessity of treatment at other times. See Winter Manual.

The PEAR LEAF BLISTER MITE, *Eriophyes pyri*, gives evidence of its presence about the time the young leaves become full grown. Pinkish-thickish patches appear, sometimes extending over the entire leaf. Later in the season these patches become corky and of a dark or black color. Within these corky galls, myriads of microscopic white mites can be found with a magnifying lens, these being the cause of the disfigurements observed. The young fruit, as well as the leaf, is sometimes thus disfigured. The foliage often falls and the fruit crop is sometimes lost. The only season when treatment can be effectually applied is in the winter, but the symptoms of the disease are here recorded in order that the insect's presence may be recognized and, where present, a campaign for the following winter prepared against it.

The PEAR TREE BLISTER BEETLE, *Pomphopaea aenea*, greenish-blue in color, inclining to a metallic luster and somewhat more than half an inch long, attacks the blossoms of the pear, destroying first the corolla and then the pistil and calyx. They will also eat portions of the newly formed fruit. The remedy is to jar the trees in the early morning. The beetles readily drop to sheets spread on the ground for the purpose, and may be destroyed by being put into a pail of water with a kerosene film over it.

The PEAR SLUG, *Eriocampoides limacina*, is the larva of a small, glossy black, four-winged insect about one-fifth of an inch long, that appears on the wing in April and May. The eggs are laid beneath the skin of the leaves of pear, cherry, quince and plum, hatching about two weeks later. The young larvae, slimy snail-like creatures, are not apt to attract attention until late May, at which time the foliage attacked by them appears eaten or skeletonized on the upper side, only the larger veins remaining undevoured. The grown slug is about half an inch long, olive-brown or dirty green in color, having the anterior segments of the body enlarged and the posterior ones tapering down to the tail, the whole body being somewhat shaped into the form of a club. Dry-slaked lime freely dusted upon them by hand, or with a powder gun, will kill them. One part of hellebore, mixed with four parts of dry-slaked lime, is still more effective. Pyrethrum may be substituted for hellebore in the lime mixture, and results will also be good. The arsenites are effective but care should be used in applying them on fruits that are nearly matured and quick in ripening, such as cherries. Even road dust will kill the worms if it is thoroughly applied.

GENERAL PROGRAM OF TREATMENT FOR THE PEAR. *

When to Spray	For what to spray	With what to spray	Remarks
(Special) Early spring before buds open.	San Jose scale, oyster shell scale, scurfy scale, *Psylla*, pear-leaf blister mite, and blight.	Lime-sulfur wash, kerosene emulsion or soluble oil.	Not necessary unless these diseases are present. Lime-sulfur seems to possess considerable value against pear blight, The oils are somewhat more efficacious against *Psylla* and blister mite.
1. Just before blossoms open.	Scab, leafblight, leafspot, fire blight and leafeating insects.	Arsenate of lead or other arsenicals in Bordeaux mixture.	
2. Just after blossoms fall.	Diseases and insects listed under 1 and codling worm.	Same as above.	Make very thorough spraying to destroy codling worm.
3. Ten to fifteen days after 2.	Same as above.	Same as above.	
(Special) Late May or early June.	Scurfy scale and oyster shell scale.	Kerosene emulsion or whale oil soap.	Spray when young scales are observed to be crawling in numbers over the bark.
(Special) During dormant season and whenever disease appears.	Blight.	Prune out affeeted twigs and burn. Disinfect knife after each cut by wiping off with a cloth moistened with kerosene. Prune so as to form a low-headed branching top.	A disease that is difficult to combat.

* The program for apple may be followed where apple pests, not here listed, attack the pear.

PLUM INSECTS.

MARCH—APRIL.

The PLUM GALL MITE, *Eriophyes phloeocaptes*, hibernates during the winter in small sub-spherical galls at the base of the buds. A cluster of galls may completely surround the twig. In early spring the mites leave these galls to form new ones. The newer galls are plump and smooth, but the older ones become dry and wrinkled. Prune out the infested twigs before the buds swell and burn them. Spraying thoroughly with lime-sulfur about the time the buds are swelling will doubtless prove a valuable measure against these mites.

During the winter months and in early spring the larvae of several species of SOFT SCALES, as *Eulecanium nigrofasciatum*, *Eulecanium armeniacum*, *E. persicae*, and *E. prunastri*, are attached to the limbs and twigs, usually on the under side. At this time, they are sometimes quite flat and scale-like, again are more rounded and blister-like, approaching a hemispherical form. They are usually brown, reddish-brown, or blackish in color. As the spring months advance, the scales enlarge and become more rounded in form. Myriads of eggs in the shape of a whitish powder are laid beneath the bodies of the scales in late spring or early summer. The best remedy is kerosene emulsion, one part of emulsion to six parts of water, used as a spray before the trees have awakened from their dormant condition. Or, instead, use whale oil soap, one pound in one gallon of water. The lime-sulfur sprays have not proved very useful against these scales. If early treatment was neglected, spray with whale oil soap, one pound in seven or eight gallons of water, when the the young are observed to be hatching and crawling over the bark. Two treatments about a week apart will generally be advisable.

The following insects attacking apple, also attack plum. Refer to the apple section for information regarding treatment:

SPRING CANKER WORM, *Paleacrita vernata*. See page 39, 40.
FALL CANKER WORM, *Alsophila pometaria*. See page 40.
SAN JOSE SCALE, *Aspidiotus perniciosus*. See page 39.
EYE SPOTTED BUD MOTH, *Tmetocera ocellana*. See page 39.
APHIDS, (*Phorodon humuli*, *Aphis pruni*, etc.) See page 41.
LEAF CRUMPLER, *Mineola indigenella*. See page 42.

Refer to the peach section for treatment for PEACH BORER, *Sanninoidea exitiosa*. See page 63.

MAY.

Refer to apple section for these:

APPLE TREE TENT CATERPILLAR, *Malacosoma americana*. See page 46.
FOREST TENT CATERPILLAR, *Malacosoma disstria*. See page 46.
PLUM CURCULIO, *Conotrachelus nenuphar*. See page 50.

While spraying, as pointed out in the apple section, is the most practicable remedy for CURCULIO in large orchards, the jarring method is preferred by some where the orchards are small. When alarmed by a sudden jar, the curculio will drop from the tree to the ground as if dead and remain motionless, "playing possum," for quite an interval. Spread sheets on the ground beneath the trees and then hit the trunks a sharp blow with a wooden

mallet which may be padded with leather to prevent bruising the bark. Several trees may be jarred in this manner before the beetles are collected from the sheets. Put the beetles in a pail of water with a little kerosene floating on top to kill them. Jarring can be successfully done only in the early hours of the morning, usually between 4 a. m. and 8 a. m. Each tree should be jarred two or three times per week during May and June. Sometimes sheets are spread on frames so as to make their transportation easy, and gangs of cheap laborers are employed to carry and arrange them under the trees in advance of the man who carries the hammer on a long handle and is kept busy rapping the trunks.

The PLUM GOUGER, *Coccotorus prunicida*, like the curculio, is a small snout-beetle, a little more than one-fourth of an inch long, with yellowish thorax and legs, and brownish head and wing-covers which are mottled with white and black spots. There are no humps on the wing-covers as with the curculio. The beetle hibernates over winter, and at blossoming time eats a hole through the calyx or green cup-like base of the blossom, thrusts its curved snout through the opening, and devours the ovule or embryo fruit. The eggs are laid in the fruit in holes, externally resembling pin holes, but scooped out and enlarged at the lower end. As soon as the young grub hatches from the egg it burrows its way through the flesh to the young pit, and there subsists on the interior substance of the seed. No external sign of its presence will be left except a small scar from which the gum exudes. As the fruit increases in size, it often develops malformations and becomes knotty in appearance. Spraying is not entirely satisfactory against this pest but is of some help. One spraying to coat the green calyx cups just before the blossoms open is probably the most important application. Subsequent sprayings should be as for curculio. The gouger may also be collected by the jarring process like the curculio, but does not drop so readily, and must be secured promptly after falling, since it quickly takes wing.

Consult the apple section for an account of these:

FLAT HEADED BORER, *Chrysobothris femorata*. See page 51.
FRUIT TREE BARK BORER, *Scolytus rugulosus*. See page 51.
SCURFY SCALE, *Chionaspis furfurus*. See page 51.
OYSTER SHELL SCALE, *Lepidosaphes ulmi*. See page 51.

Refer to pear section:

PEAR SLUG, *Eriocampoides limacina*. See page 56.

EXPLANATION OF PLATE VII.

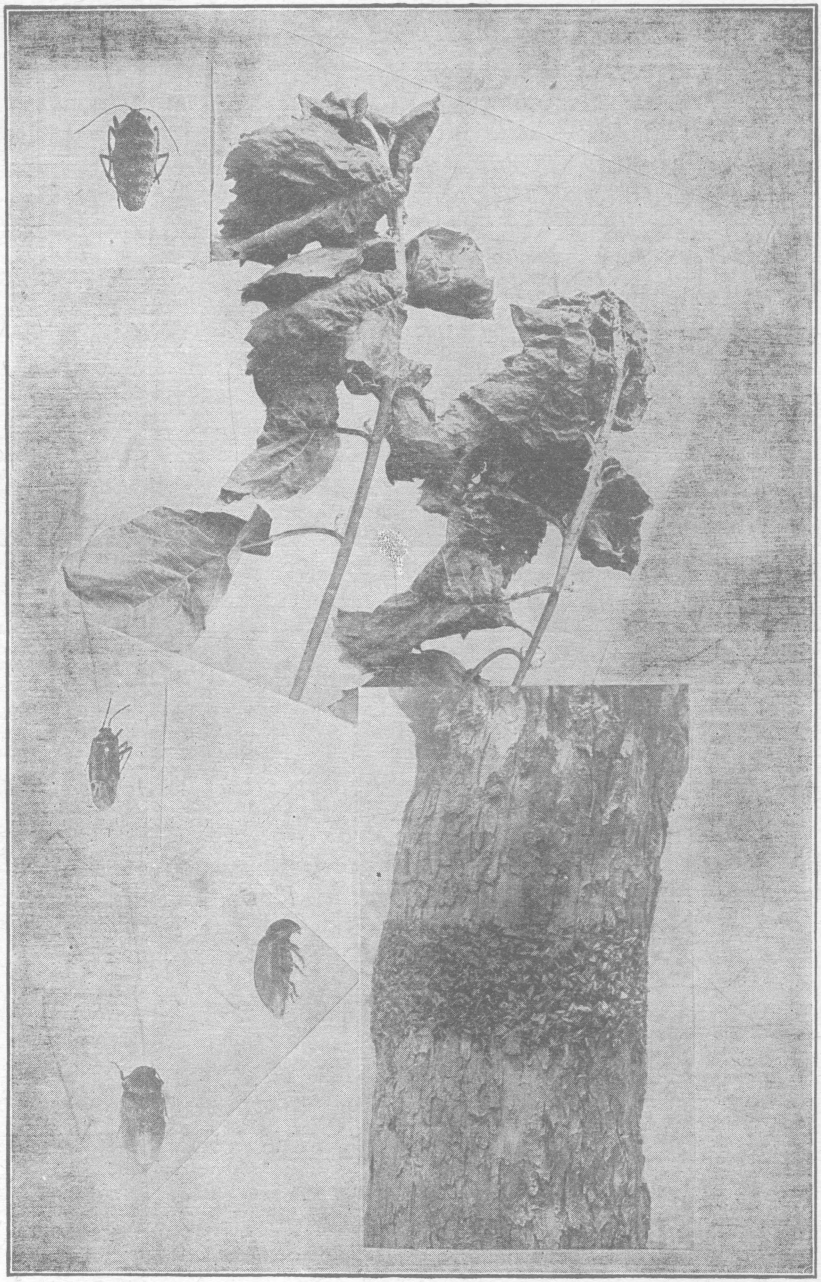
a Female canker worm.
Negative by Houser.

b Leaf injured by aphids.
Negative by Houser.

c Raspberry Byturus. Adults, enlarged.
Photo by Goodwin.

d Canker worm moths caught in sticky band.
Negative by Houser.

e Four-lined plant bug. Adult, slightly enlarged.
Negative by Houser.



GENERAL PROGRAM FOR TREATMENT OF PLUM.

When to spray	For what to spray	With what to spray	Remarks
(Special) Before buds open in early spring.	San Jose scale.	Lime-sulfur or soluble oil.	Not necessary unless scale is present.
Same as above.	Soft scales or lecaniums.	Kerosene emulsion, diluted with 7 or 8 parts water.	Apply on sunshiny day.
1. Just before the blossoms open.	Curculio, rots and diseases.	Bordeaux mixture combined with arsenate of lead. On European varieties use standard Bordeaux, on American and Jap. varieties weak Bordeaux.	An important application against rot. Also necessary against curculio.
2. Just after the blossoms fall.	Curculio, brown rot and leaf spot.	Same as above.	The most important application against curculio.
3. Ten to fifteen days after 2.	Same as above.	Same as above.	Necessary against curculio.
4. About the middle of June.	Rot and leaf-spots.	Dilute Bordeaux.	
5. Late July or early August.	Same as above.	Ammoniacal copper carbonate or eau-celeste. Self-boiled lime-sulfur, made with cold water, is worthy of trial.	Change from Bordeaux to these fungicides when the fruit begins to color. Bordeaux used at this time spots the ripening fruit.

PEACH INSECTS.

MARCH—APRIL.

Several species of *Eulecanium* feed on peach. Most of the species already considered in the plum section and perhaps a few others besides, are also recorded on peach. Treatment for these have been given in Plum Section, page 58.

Refer to the apple section for these:

SPRING CANKER WORM, *Paleacrita vernata.* See pages 39, 40.

FALL CANKER WORM, *Alsophila pometaria.* See page 40.

SAN JOSE SCALE, *Aspidiotus perniciosus.* See page 39.

SHOT HOLE BORER, *Scolytus rugulosus.* See page 51.

The PEACH TREE BARK BEETLE, *Phloeotribus liminaris*, resembles the shot hole borer but is slightly more slender and smaller. The damage resembles that of the shot hole borer. Remedies are the same.

The WALNUT SCALE, or GOPHER SCALE as it is known in the southern states, *Aspidiotus juglans-regia*, is often a scourge among peach trees. It looks much like San Jose scale, but is considerably larger, and does not become so black in color as some of the stages of San Jose. The same treatment as for San Jose is said to be effective.

The PEACH BORER, *Sanninoidea exitiosa*, is the most universally distributed of peach pests. It may generally be found around the foot of the tree, slightly beneath the surface of the soil, burrowing beneath the bark, thereby causing a copious exudation of gum. Go over the trees as early as convenient in the spring, dig the worms out with a knife and kill them. Some prefer to use scalding water for destroying them in order to prevent mutilation of the bark. An emulsion of chloronaptholeum or of creolin, one part of naptholeum to one hundred and fifty parts of water, would probably give as good results as scalding water.

The PEACH TWIG BORER, *Anarsia lineatella*, is best destroyed by kerosene emulsion, diluted with seven parts of water, applied in early spring or in winter. The caterpillars spend the winter in minute, silk-lined tunnels in the thickened, spongy bark in the axils of the small twigs. Their presence here is disclosed by little mounds of sawdust or finely ground bark. They begin to migrate to the twigs about the time the buds are swelling in the spring, and in some instances have been destroyed by a spray of lime-sulfur wash during the migrating period. Most of the damage is done in late April or early May, by the larvae tunneling into the new wood, thus killing the terminal growth. No remedy avails at this period.

PEACH APHIDS may be treated like apple aphids, page 41. The BLACK PEACH APHIS, *Aphis persicae-niger*, feeds on both the foliage and the roots like the woolly plant louse of the apple. All trees received from the nursery should be closely inspected for the pest, since it is a very deceptive and dangerous one. The root form is dark brownish-black, polished and shiny. The form which lives above ground is black, with under side of body dark brown. If there is any possibility that the louse is present, wash the soil from the roots, immerse them in tobacco decoction (Winter Manual p. 13) and, before planting out, puddle the roots in tobacco-impregnated mud as discussed for apple-root louse, page 42.

Consult the apple section for information about these:

LEAF CRUMPLER, *Mineola indigenella*. See page 42.

CLIMBING CUTWORMS, *Mamestra subjuncta*, et al. See page 43.

OBLIQUE BANDED LEAF ROLLER, *Archips rosaceana*. See page 43.

MAY.

The following which attack peach have been treated in the apple section:

APPLE TENT CATERPILLAR, *Malacosoma americana*. See page 46.

FOREST TENT CATERPILLAR, *Malacosoma disstria*. See page 46.

PLUM CURCULIO, *Conotrachelus nenuphar*, page 50, also plum section, page 58.

EXPLANATION OF PLATE VIII.

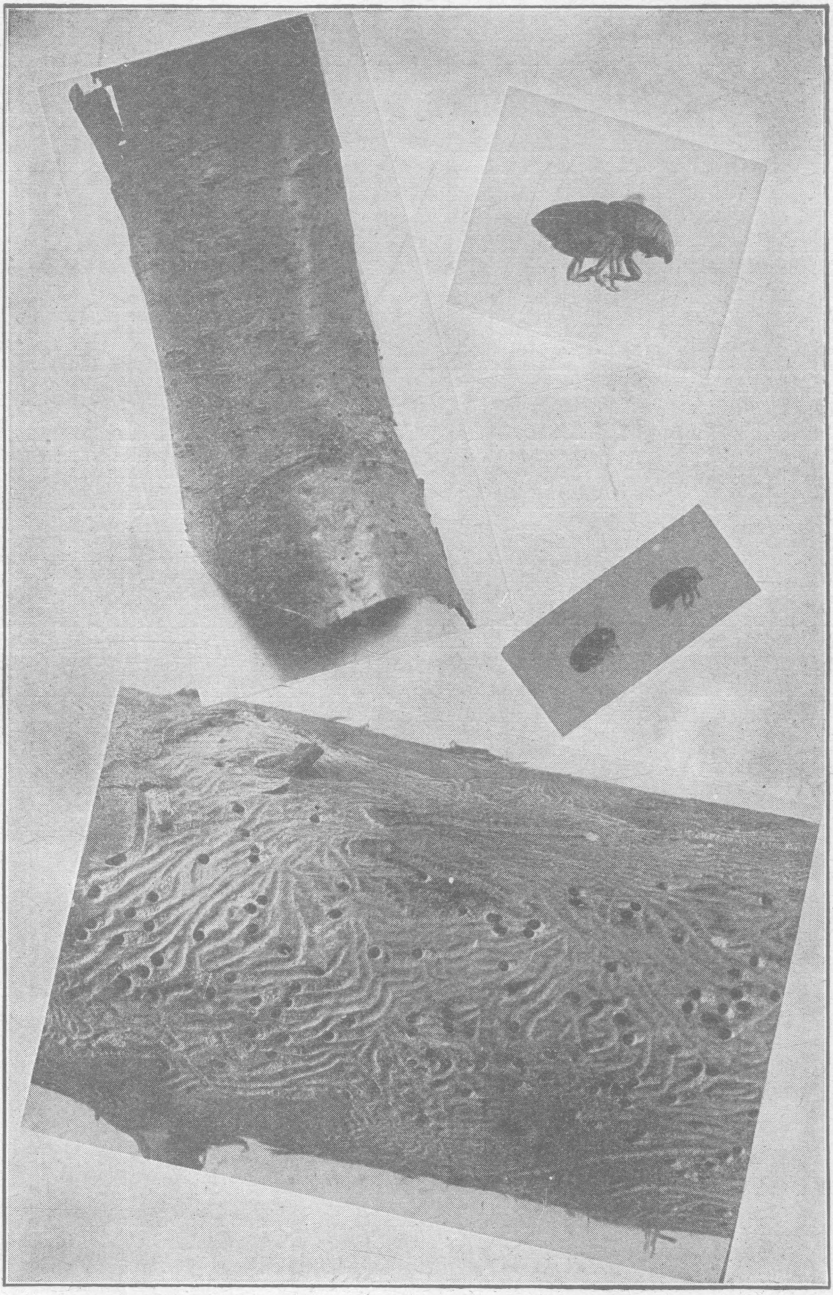
a Shot hole borer, *Scolytus rugulosus*, enlarged.

b Appearance of bark after shot-hole and bark-borers have emerged.

c Peach bark beetle, *Phloeotribus liminaris*, enlarged.

d Shot-hole borer engraving work on peach limb; also holes of pupae, or pupal cells.

Photos by Goodwin.



GENERAL PROGRAM OF TREATMENT FOR THE PEACH.

When to spray	For what to spray	With what to spray	Remarks
(Special) Before buds open in early spring.	San Jose scale and peach leaf-curl.	Lime-sulfur or soluble oil.	Lime-sulfur should be used for leaf-curl whether scale is present or not.
(Special) Before buds open in early spring.	Soft scales or lecaniums.	Kerosene emulsion diluted 6 to 8 times, two applications one week apart, or use soluble oil.	
1. Before the buds open, or better before they swell.	Leaf-curl scab and brown rot.	Lime-sulfur or Bordeaux.	If the lime-sulfur is applied very early in spring the results against leaf-curl are likely to prove best.
2. Just before blossoms open.	Diseases under 1 and curculio.	Bordeaux combined with arsenate of lead.	
3. Just after blossoms fall.	Same as above.	Dilute Bordeaux and arsenate of lead.	Important if curculio is abundant.
(Special) One week after 3.	Curculio.	Arsenate of lead.	Apply if curculio is numerous, also jar trees and collect beetles if they are very destructive.
4. Ten to fifteen days after 3.	Scab and fungous diseases	Self-boiled lime-sulfur made with cold water.	Do not mix arsenicals with this spray.

CHERRY INSECTS.

MARCH.

See apple section for these:

SPRING CANKER WORM, *Paleacrita vernata.* See page 39, 40.

FALL CANKER WORM, *Alsophila pometaria.* See page 40.

SAN JOSE SCALE, *Aspidiotus perniciosus.* See page 39.

SCURFY SCALE, *Chionaspis furfurus.* See page 51.

See Plum Section for this:

SOFT SCALES, *Eulecanium* spp. See page 58.

See Peach Section for this:

WALNUT SCALE, *Aspidiotus juglans-regiae.* See page 62.

APRIL.

See Apple Section for these:

BUD MOTH, *Tmetocera ocellana.* See page 39.

LEAF CRUMPLER, *Mineola indigenella.* See page 42.

FRUIT BARK BEETLE, *Scolytus rugulosus.* See page 51.

PEACH BARK BEETLE, *Phloeotribus liminaris.* See page 62.

The BLACK CHERRY PLANT LOUSE, *Myzus cerasi,* attacks the leaves as soon as they expand, congregating on them in great numbers beneath, and attracting swarms of flies and honey-loving insects by a profuse excretion of honey dew. The leaves often become badly crumpled under the attack, and the tree may not recover a wholly healthy appearance during the whole season. Treatment same as for apple aphids, page 41.

See apple section for this:

OBLIQUE BANDED LEAF ROLLER, *Archips rosaceana*. See p. 43.

A large FLAT HEADED BORER, the larva of *Dicerca divaricata*, occasionally attacks the cherry in much the same way as the apple borers attack apple. The same remedies may be used. See pp. 50-51.

MAY.

The MAY BEETLE, *Lachnosterna fusca*, and some of its near relatives often attack the foliage in numbers in May. The only feasible remedy is to shake infested trees early in the morning, over sheets spread on the ground beneath to catch the falling beetles. Kill the insects by throwing into a pail of water with kerosene floating on the surface, or use boiling water.

See Apple Section for these:

APPLE TREE TENT CATERPILLAR, *Malacosoma americana*. See page 46.

FOREST TENT CATERPILLAR, *Malacosoma disstria*. See page 46.

PLUM CURCULIO, *Conotrachelus nenuphar*. See page 50.

SCURFY SCALE, *Chionaspis furfurus*. See page 51.

See Pear Section for these:

PEAR SLUG, *Eriocampoides limacina*. See page 56.

PEAR TREE BLISTER BEETLE, *Pomphopaea aenea*. See page 56.

GENERAL PROGRAM OF TREATMENT FOR THE CHERRY.

When to spray.	For what to spray.	With what to spray.	Remarks.
(Special) Early spring before buds open.	San Jose scale and Putnam scale.	Lime-sulfur.	Not necessary unless scale is present. Sour cherries are not seriously attacked by San Jose.
(Special) Early spring before buds open.	Soft scales or lecaniums.	Kerosene emulsion diluted 6 or 8 times, two applications one week apart, or use soluble oil.	
1. Just before blossoms open.	Rot and curculio.	Bordeaux mixture combined with arsenate of lead.	Important against rot.
2. Just after the blossoms fall.	Curculio, rot and leaf-spot.	Dilute Bordeaux combined with arsenate of lead.	The most important application against curculio.
3. Ten to fifteen days later than 2.	Rot and leaf-spot.	Ammoniacal copper carbonate or self-boiled lime-sulfur made with cold water.	These fungicides discolor this early maturing fruit less than Bordeaux mixture.
4. After the fruit is picked.	Leaf-spot.	Bordeaux—use 2-4-50 formula.	
5. From two to three weeks after 4.	Same as above.	Same as above.	

EXPLANATION OF PLATE IX.

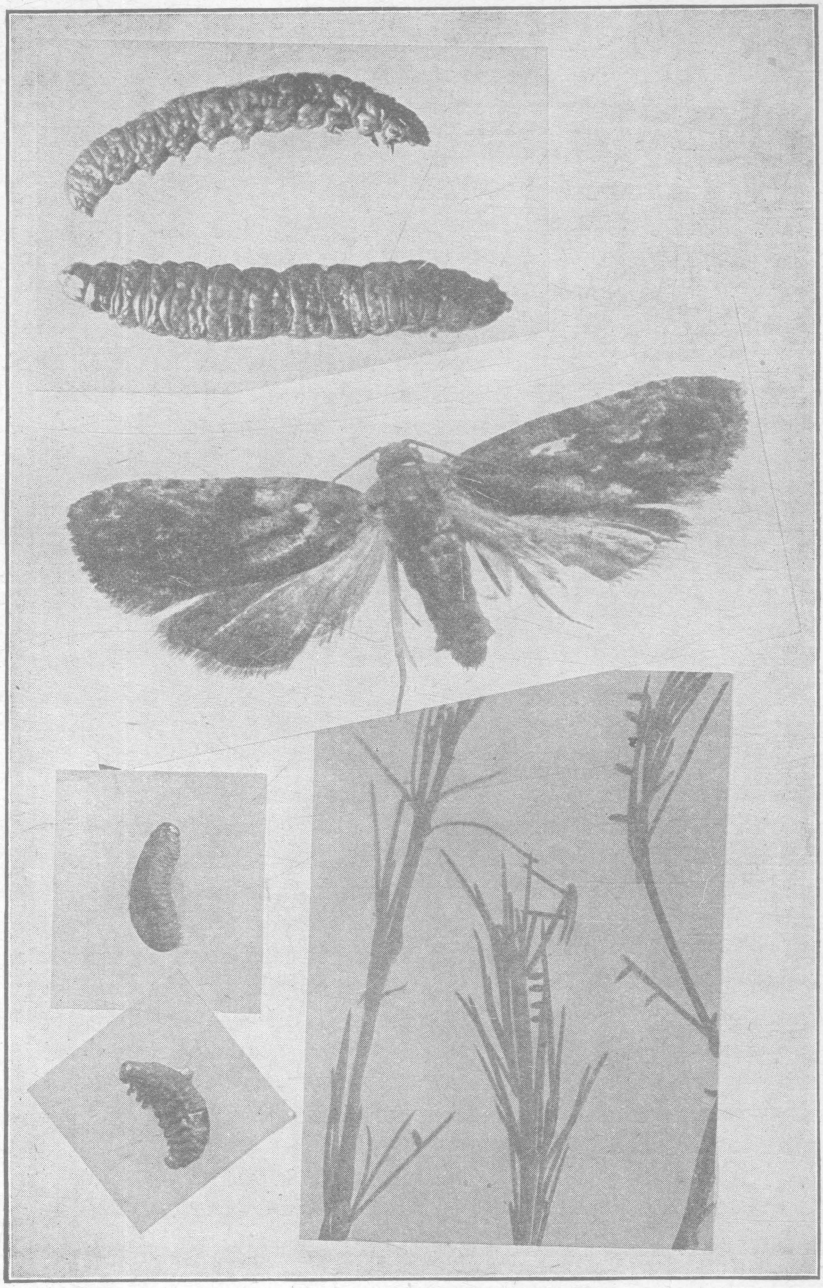
a Grapeberry worms, much enlarged.

b Moth of Grapeberry worm, much enlarged.

d and e Asparagus beetle larvae, *Crioceris asparagi*.

f Asparagus beetle eggs.

Photos by Goodwin.



QUINCE INSECTS.

MARCH.

See Apple Section for treatment of these:

SAN JOSE SCALE, *Aspidiotus perniciosus*. See page 39.

APRIL.

See Apple Section for these:

LEAF CRUMPLER, *Mineola indigenella*. See page 42.

ROUNDED HEADED BORER, *Saperda candida*. See page 50.

This insect is very injurious to the quince.

MAY.

See Pear Section for these:

The PEAR TREE BLISTER BEETLE, *Pomphopaea aenea*. See p. 56

The PEAR SLUG, *Eriocampoides limacina*. See page 56.

See Apple Section for these:

CODLING MOTH, *Carpocapsa pomonella*. See page 47.

GENERAL PROGRAM FOR TREATMENT OF QUINCE.

Same as for Apple—See page 52.

GRAPE PESTS.

MARCH--APRIL.

In the Winter Manual we have emphasized the importance of clean culture. The work of cleaning up the leaves, burning over the borders of the vineyard, and stirring the surface of its soil, should never be deferred until spring if it is possible to do it in the fall or early winter. Spring cleaning up is less effective, in the vineyard, than fall work of the same kind, but it is much better than none. So far as possible, get the leaves out on the borders and burn. It may sometimes be necessary to spray with crude oil over the collected refuse and the thin portions of the border before setting on fire. Cleaning up and burning is very important against the LEAF HOPPER or GRAPE "THRIPS," the GRAPE FLEA BEETLE, the GRAPEBERRY WORM and the GRAPE CANE GALLMAKER. After pruning, burn all the trimmings. This will destroy the eggs of TREE CRICKETS and similar insects as well as the larvae and pupae of various insects working within or adhering to the canes.

MAY.

In late May or early June, depending on the latitude and the season, the GRAPEBERRY MOTH appears and lays its eggs among the bloom clusters. The GRAPE CURCULIO appears about the same time. Since both insects usually appear about the first of June, a fuller mention of each is reserved for the Summer Manual.

GENERAL PROGRAM FOR TREATMENT OF GRAPES.

When to spray	For what to spray	With what to spray	Remarks
(Special) Before buds open in spring.	Anthracnose.	Sulfate of copper solution or Bordeaux.	Not necessary unless disease is present.
(Special) As buds are swelling.	Flea beetle.	Arsenate of lead.	Unnecessary unless the insect is present.
1 Just before the blossoms open.	Mildew, black rot, berry worm and curculio.	Bordeaux combined with arsenate of lead and some form of sticker, such as iron sulfate or soap added.	Very important against berry worm and rot. Very thorough spraying is necessary.
2 Just after the fruit sets.	Same as above.	Same as above.	Same as above.
3 Ten days to two weeks after 2.	For the foregoing and for root worm.	Same as above.	
4 About first week in July. Not later than the 20th.	Same as above.	Same as above.	Probably the most important treatment of all for berry worm. Too late an application leaves spray adhering to fruit at harvest time.
(Special) At intervals of seven to ten days after 4, until fruit is two-thirds grown.	Black rot.	Ammoniacal solution of copper carbonate.	This mixture does not stain fruit like Bordeaux. In ordinary seasons this treatment will be unnecessary if regular sprayings are thoroughly made.

CURRANT AND GOOSEBERRY INSECTS.

MARCH--APRIL.

Nearly all, if not all, of these insects attack both fruits.

SAN JOSE SCALE, *Aspidiotus perniciosus*. Spray with lime-sulfur.

SCURFY SCALE, *Chionaspis furfurus*. " " " "

OYSTER SHELL SCALE, *Lepidosaphes ulmi*. " " " "

IMPORTED CURRANT BORER, *Sesia* (*Aegeria*) *tipuliformis*. See Winter Manual.

NATIVE CURRANT BORER, *Psenocerus supernotatus*. See Winter Manual.

The CURRANT SPAN WORM, *Cymatophora ribearia*, appears as a small measuring worm just after the leaves expand. When full grown, it is about one inch long, color whitish, with broad yellow stripes on back and sides, each segment being dotted with some black spots. If disturbed, the caterpillar drops toward the ground by means of a web spun from its mouth. Therefore, the bushes may be jarred and the suspended worms collected and destroyed. Arsenate of lead, applied while the fruit is very young, is safe and effective. For late treatment, dust with fresh pyrethrum mixed

with an equal quantity of flour. The adult moth expands over an inch and has pale yellow wings marked with dusky spots. It appears in June or July and fastens its eggs to the stems. The eggs do not hatch until the following spring.

The CURRANT FRUIT WORM, *Eupithecia implicata*, is another span worm, but has ten legs instead of sixteen as is the case with the preceding species. It eats holes into the sides of the fruit. Dust with pyrethrum or spray with strong hellebore.

MAY.

The adult females of the IMPORTED CURRANT WORM, *Pteronus ventricosus*, appear early in May or late in April, and lay their eggs in rows along the midribs on the veins of the leaves. In about ten days the eggs hatch into dull white larvae which later become yellowish-green and dotted over with many black spots. When full grown, the larvae are about three-fourths of an inch long and often defoliate the bushes. The best remedy is to dust the bushes in the morning while the due is on with white hellebore mixed with four parts, by weight, of flour, or pyrethrum may be used in the same way. Arsenate of lead may be applied as a spray while the fruit is very young, but not much later than the setting period. The adult female is a four-winged sawfly, with a honey-yellow body and black head. The male is black, with yellow spots and yellow legs.

The FOUR LINED PLANT BUG, *Poecilocapsus lineatus*, appears in the nymph form about the middle of May, or a little earlier. The young nymphs are shining vermillion red, marked with black spots on the thorax. They attack the tender leaves near the tips of the twigs. Small brown spots appear at the points where their bills were inserted, and eventually entire leaves and even the shoots may die. The adult insects, which appear in early June, are about one-third of an inch long, orange-yellow in color, with four stripes on the back. The eggs are carried over winter in the tips of the canes, hence, early spring and winter pruning and burning of these will prevent hatching. The young may be destroyed by spraying with kerosene emulsion diluted with five parts of water.

SCURFY SCALE, *Chionaspis furfurus*, young hatch middle of May. See page 51.

OYSTER SHELL SCALE, *Lepidosaphes ulmi*, young hatch middle of May. See page 51.

THE GOOSEBERRY FRUIT WORM, *Zophodia grossulariae*, bores into the growing berries, causing them to color prematurely and fall. Several berries may be fastened together as one after another is eaten out by the caterpillar. The moth has an expanse of nearly an inch, the fore wings being pale gray with dark streaks and bands.

The hind wings are pale dusky. The moths appear abont the time the bushes are in bloom and lay their eggs on the newly set berries. The pupal stage is passed in a brown, paper-like cocoon, among the leaves on the ground, the pupal period extending from July until the following spring.

Hand-picking the wormy berries is the most reliable remedy but this must be deftly done, since the worms, when disturbed, have the habit of quickly wriggling from the berries and making a rapid descent to the earth by means of a silken thread spun for the occasion. Burning the trash from under the bushes in early spring is also of help in destroying the pupae.

The GOOSEBERRY MIDGE, *Cecidomyia grossulariae*, is a small, yellowish fly, about one-tenth of an inch long, which deposits its eggs beneath the skin of the young fruit. Remedy, hand-picking and destruction of the infested berries.

The CURRANT FLY, *Epochra Canadensis*, is an orange-colored fly, about the size of an ordinary housefly, and has the same general habit as the preceding species. The white maggot, which develops in the fruit, acquires the length of about one-third of an inch when mature. Remedy, hand-picking and destruction by burning of the infested berries which color and prematurely fall to the earth.

GENERAL PROGRAM FOR TREATMENT OF CURRANT AND GOOSEBERRY.

When to spray	For what to spray	With what to spray	Remarks
(Special) Before leaves open.	San Jose scale, scurfy scale and oyster-shell scale.	Lime-sulfur.	Not necessary unless scale insects are present.
1 When leaves are unfolding.	Leaf-spot and mildew.	Bordeaux.	Application for mildew on gooseberries may be given before leaves begin to open.
2 Two weeks after 1.	Leaf-spot, mildew, imported currant worm and currant span worm.	Bordeaux combined with arsenate of lead.	Arsenate of lead, if applied just before blooming, adheres long enough to destroy currant worms when they appear.
(Special) Whenever necessary and as often as necessary.	Imported currant worm.	Hellebore 1 ounce in 3 gallons of water, or dust with hellebore 1 part and dry slaked lime 4 parts.	Apply dust while dew is on leaves in the morning.
3 Two weeks after 2.	Leaf-spot and mildew.	Potassium sulfid or sodium sulfid or self-boiled lime-sulfur made with cold water.	Bordeaux, if used at this time, spots the fruit.
4 After fruit is picked.	Leaf-spot.	Bordeaux.	
(Special) Late fall.		Bordeaux.	If leaf-feeding insects have annoyed badly during the season, rake up and burn fallen leaves and trash under the bushes. A straw mulch may then be applied to prevent winter killing.

RASPBERRY AND BLACKBERRY INSECTS.

MARCH.

Raspberry and blackberry canes are sometimes badly infested with a white scale, *Aulacaspis rosae*, commonly known as ROSE SCALE. This insect passes the winter in all stages from egg to adult. Probably no better treatment can be suggested than to cut out all badly infested twigs in spring and burn, and spray the remainder thoroughly with lime-sulfur before the leaves appear. If hatching is vigorous in April, spray with kerosene emulsion diluted with 12 parts of water.

SCURFY SCALE and OYSTER SHELL SCALE, when present, may be sprayed with lime-sulfur in spring before the leaves appear, and in late May with kerosene emulsion if they threaten damage.

See Winter Manual for these:

GOUTY GALL BEETLE, *Agrilus ruficollis*.

SNOWY TREE CRICKETS, *Ecanthus* sp.

APRIL AND MAY.

BUD MOTH, *Tmetocera ocellana*. See page 39.

The RASPBERRY SAWFLY, *Monophadnus rubi*, is a four-winged fly which appears with the unfolding of the leaves. The front part of its body is black, the abdomen dark reddish. The transparent wings are veined with black. The eggs are deposited beneath the skin of the leaf, along the midrib and veins, and hatch into small, whitish slugs which later become of a greenish hue. Spraying with poisons before the fruit is much grown, or with hellebore later, will be effective; or, dust in early morning with hellebore and flour, or with dry-slaked lime.

The BLACKBERRY CROWN BORER, *Bembecia marginata*, does considerable damage. After growth starts in the spring, some canes may be found to be dead. In some cases, an examination will reveal at the base of such canes, a 16-legged borer, resembling the peach borer. Many of such canes will be found to have been partially girdled just at the base during the preceding fall, and the pith of the same bored out by the caterpillar. The parent moth is a clear winged insect, quite resembling a brightly colored wasp. The body is black, banded and marked with yellow. The eggs are laid in the fall. The most reliable remedy is to cut out all infested canes as soon as they are discovered and burn, taking care not to allow any of the borers to escape from the canes before they are burned.

The PALE BROWN BYTURUS or AMERICAN RASPBERRY BEETLE, *Byturus unicolor*, appears just as the buds are swelling and eats holes in them, and devours the essential organs of the flowers after they

are expanded. This beetle is less than one-sixth of an inch long, yellowish-brown in color, and densely covered with pale yellow hair. Where the blossom has been attacked, but not destroyed, the fruit is one-sided and imperfect. Whole crops are sometimes destroyed in this way. The small whitish worms feed upon the fruit and are found adhering to the fruit at picking time. The beetles work most in the morning and the evening and are not much seen at midday. Handpicking, mornings and evenings, may be satisfactory in small gardens. In large plantings, spraying with arsenate of lead, while the buds are swelling and after the blossoms are open, has been tried with success. The applications may be made with vineyard sprayers, such as are used for grapes.

TARNISHED PLANT BUG, *Lygus pratensis*. See page 76.

GENERAL PROGRAM OF TREATMENT FOR RASPBERRY AND BLACKBERRY.

When to spray	For what to spray	With what to spray	Remarks
(Special) Before leaves open.	Rose scale, San Jose scale and other scales.	Lime-Sulfur.	Cut out and burn the badly injured canes. Spray thoroughly.
(Special) Usually in April.	Rose scale.	Kerosene emulsion.	Use, if hatching is vigorous after the lime-sulfur treatment—an improbable contingency. Dilute emulsion with 12 parts water.
1 Before leaves open.	Anthracnose.	Bordeaux.	
(Special) When buds are swelling.	Pale Brown Byturus.	Arsenate of lead.	Apply very thoroughly.
2 While blossoms are open.	Same as above.	Same as above.	Apply very thoroughly. Bees are likely to be poisoned by this application, but the raspberry crop sometimes cannot be saved without it.
3 When young canes are six inches high.	Anthracnose, leaf-spot.	Weak Bordeaux.	So for as possible, keep spray from leaves on the bearing canes.
4 One week after 3.	Same as above.	Same as above.	Same as above.

STRAWBERRY INSECTS.

MARCH--APRIL--MAY.

In some parts of the country the STRAWBERRY ROOT LOUSE, *Aphis forbesi*, multiplies upon the roots of the strawberry during the growing season until the plants are sapped of their vitality and many of them killed. Dead and unhealthy plants, together with

numerous ants among the vines, should incite an immediate examination of the roots. Upon pulling up an infested plant, many of the roots may be found covered with clusters of small, bluish-black lice. Symptoms like the foregoing do not appear until April or May, but the eggs hatch in late March or early April. Whenever there is good reason for supposing the pest to be present, the beds should be burned over in March if this operation was neglected the preceding fall. The very small, shiny black eggs of the louse are laid upon the stems and along the ribs of the green leaves late in fall, usually in late October and November. A mulch of straw kept over the beds in winter will facilitate firing in the spring. In choosing new plants for setting, be sure to use only such plants as come from uninfested beds. If it is impossible to procure clean plants, fumigate the suspicious ones with hydrocyanic acid gas, or dip them in tobacco water, and plant on ground that has not grown strawberries, corn or melons, for a year or more. The reason for avoiding corn and melon land is to dodge the ants that specially care for the different species of aphids that feed on corn, melons and strawberry.

New strawberry plants should not be set on land that has been in grass at any time for two or three years preceding, unless such land is certainly known to be free from the WHITE GRUB.

Various species of CUTWORMS may appear in spring in the beds, or among newly set plants, and do great damage. To destroy these, place poisoned bran bait under boards scattered over the field. See page 78.

The TARNISHED PLANT BUG, *Lygus Pratensis*, attacks the bloom and the forming berries, often causing what is known as the buttoning of strawberries, blackberries, etc. This is a flat, brownish bug, less than one-fourth inch long, marked with yellow and black, giving it the appearance of tarnished brass, Kerosene emulsion made with pyrethro-fishoil soap is probably as effective as any known remedy, but no treatment is very satisfactory.

GENERAL PROGRAM FOR STRAWBERRY TREATMENT.

When to spray	For what to spray	With what to spray	Remarks
1. When leaves are about one-half grown.	Leaf-spot or "rust".	Bordeaux.	Some varieties are not much subject to this disease and may not need spraying. Fruiting beds should be sprayed before blooming. During season of setting, beds may be sprayed almost any time.
2. About two weeks after 1.	Same as above.	Same as above.	For young beds.
3. About two weeks after 2.	Same as above.	Same as above.	For young beds, and is not necessary unless disease is spreading.
(Special) Late May or early June.	Leaf-rollers and "slugs" or sawfly larvae.	Solution of hellebore, 1 oz. in 3 gallons of water.	This is to be prefered before the arsenites on fruit that is from one-half to two-thirds grown. It loses its poisonous properties a day or two after application.
4. After fruit is picked.	For all the above and various other pests.	Cut off vines and other growth close to ground with a mowing machine and burn on a windy day.	A good regular practice except that a drought following the mowing may prevent the development of a crop the following year.
(Special) After mowing and burning.	Same as above.	Bordeaux and arsenate of lead or other arsenical.	Will destroy leaf-rollers and "slugs" that escaped burning.

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury.	Remedies to use
March, April, May.	All.	Cutworms.	Stout, soft bodied, hairless, or nearly hairless caterpillars varying from light colors to nearly black. Some striped or spotted with various colors. Conceal themselves in daylight beneath surface of ground, boards, etc.; feed at night.	Cut off plants even with the ground. Some species burrow in stalks of plants, or through the growing heads and roots of vegetables. Others climb plants and even trees to devour the foliage.	Spray grass or weeds with poison on ground in preparation for cultivation several days before plowing; or scatter over the ground before planting a poisoned bran mash made as follows: use one-half pound of sugar or molasses per gallon of water, and use enough of such sweetened water to dampen 50 pounds of bran. Now add one-half pound of Paris green or white arsenic by sprinkling lightly over the surface of the bran, while vigorously stirring so as to mix the poison uniformly through the mass. Vegetables already planted may be protected by a teaspoonful being placed near the base of the plant. This poison keeps effective through a longer period if placed under boards or chips scattered through the garden. Another good poisoned bait is obtained by spraying clover or other succulent vegetation with poison, mowing the same and scattering it in fair sized heaps over the infested ground. Make the piles large enough to prevent the under portion from quickly drying out. Robins, blackbirds and bluebirds destroy many cutworms.
April, May.	All.	Grasshoppers	Generally speaking, dull colored or greenish jumping insects, at first without wings, later acquiring them.	Devouring plants clean or biting off portions, giving them a ragged, half-eaten appearance.	Use the poisoned bran mash recommended for cutworms whenever the grasshoppers appear. The Criddle mixture, consisting of poisoned horse-droppings, is used very successfully in some localities. The bait is made by thoroughly mixing by weight one part of Paris green with sixty parts of fresh horse droppings. Two pounds of salt dissolved in water is added to each half barrel of the mixture, which is now ready to be scattered around the edge of the garden and also through it by means of a wooden paddle or spade.
April, May.	Corn, beets, potatoes and many others.	White grubs.	Stout bodied, white larvae with hard yellow heads and soft bodies, that live beneath the soil. When removed from the earth, parent forms are the well known stout bodied May beetles, either light brown or dark brown in color.	Cut off roots of grain crops and grasses and cause rough, scabby growth on root crops.	Do not plant vegetable crops on land known to be badly infested. Newly plowed meadows and prairies are most apt to be badly infested. If infested land must be used for garden plot, pasture hogs on it for a few days before planting the crop. They will devour the grubs greedily. If this is impracticable, dilute kerosene emulsion five times with water and pour over the infested ground just before a rain. If rain does not come within a day or two after the application, water generously by means of a hose or by conveying the water in pails. Skunks feed voraciously on the grubs. Barnyard poultry eat them greedily when exposed by the plow.

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of the injury	Remedies to use
April, May.	Potatoes, turnips, corn, beets, cabbage, cauliflower, carrots, onions lettuce, and many others.	Wireworms.	Long, slender, cylindrical worms having hard, shining, smooth bodies of a yellowish color, with three pairs of very small legs, all located very close to the head. Parent forms are the click or snapping beetles.	Eat into grains of seed corn in the ground. Bore channels through underground portions of corn stalks. Bore through tubers of potatoes when planted for seed and while growing and stored. Erode the skins of all kinds of root crops and cut the roots of such crops as develop above ground.	Avoid planting crops specially subject to attack on infested land. If possible, choose for such crops land that has been planted to clover or buckwheat for a year or two preceding, and that was plowed the previous fall. If the worms are known to be present, soak corn in water containing strychnine or arsenic, and sow over the field and harrow in about two weeks before planting the crop. Poisoned slices of potato or bunches of clover or sweetened corn meal mash may be placed under boards scattered about the field for the purpose of attracting the beetles and destroying them.
When insects first appear.	All kinds to some degree.	Aphids or plant lice.	Greenish, blackish or reddish insects of small size, clustering on leaves or stems of plant in great numbers.	Suck the juices from the plants causing them to wither and sometimes to become blotched over or covered with a black sooty mold which grows in the honey dew excreted by the insects. Sometimes the leaves become badly curled.	Spray as often as necessary with soap solution, using one pound of whale oil soap, or other soap, in 5 to 7 gallons of water; or tobacco decoction or kerosene emulsion may be used. Much trouble is saved by treating the first comers as soon as they make their appearance.
When insects appear.	Various.	Flea beetles and leaf beetles.	Very small and generally dark colored beetles that leap like fleas.	Eat leaves full of very small holes and cause them to become blotched with minute white dots in earlier stage of injury.	Spray the greater number of plants with Bordeaux mixture only, and the remainder with arsenate of lead alone. The beetles will congregate on the poisoned plants and those sprayed with Bordeaux alone will be safe to use within two or three weeks after treatment, or sooner. Pyrethrum may be used on plants that are soon to be eaten.
April-May.	*Asparagus.	Asparagus Beetle, *Crioceris asparagi*.	Slender beetle nearly one-fourth inch long, color blue-black with reddish thorax and yellow spots on wing covers. Larvae are soft and slug-like, color dark gray or olive.	Both adults and larvae attack the tender shoots early in the season and later gnaw the older stalks. Young shoots are made unsightly by great numbers of dark eggs laid in rows of 2 to 6 and set endwise to stalks so as to project in every direction.	Cut all plants down to the ground in early spring, and cut new shoots before eggs hatch. Allow some shoots scattered over the field to grow larger than others and most of the eggs will be deposited on these. When they are well covered with eggs cut and burn and allow other shoots to grow for same purpose. The larvae may be killed by dusting with fresh air-slaked lime while dew is on in the morning. Spray with arsenate of lead later in the season when cutting period is over. Chickens and ducks will devour many if given the run of the garden.

*Alphabetical arrangement of crops begins here.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
April-May.	* Asparagus.	Twelve spotted asparagus beetle.	A trifle larger and stouter than the common species, uniformly reddish in color, with 12 black spots on the wing covers. Eggs are attached by their sides instead of ends, usually on old plants instead of young shoots if such are available.	Hibernated beetles feed on shoots in spring. Later beetles and larvae prefer the berries. Larvae seem to feed almost exclusively on the berries.	Follow same method as for the preceding where possible. Older plants may be used for traps. Owing to habit of larvae in entering berries, dusting with lime is of no avail. Spraying with poison will destroy many of the beetles.
At planting.	Beans.	Common bean weevil, *Bruchus obtectus*.	Small, chunky beetle, rather square across the back end of the body and diminishing in width toward the front to form a wedge shape. Color, brownish gray or olive.	Eat out interior of seed and make round holes through outside.	Fumigate with bisulfide of carbon before planting so no beetles will be carried to the field. If properly fumigated in fall and winter this will be unnecessary. Throw infested seed lightly into water. All floating beans should be destroyed as they are too badly injured to grow well.
Before planting and when injury becomes apparent after plants are up.	Beans.	Seed corn maggot, *Pegomya fusciceps*.	Small, footless larvae, narrowed at front end, enlarged posteriorly. Adult resembles small house fly.	Larvae scrapes and devours seeds, sprouts and stems under ground, causing them to wither and die.	Hand-picking by lifting plants from ground, removing maggots and resetting. With a force pump apply hellebore–2 oz. of powder to the gallon of water–about the roots of plants as soon as infestation is apparent. Mineral fertilizers are useful to prevent egg laying and to stimulate plants to outgrow injury; use as top dressing before planting, and afterwards a short distance from stems on surface just before or after rain. Too much fertilizer to stems or roots is dangerous to plants.
See p. 78.	Beans.	Cutworms.			
See p. 79.	Beans.	Flea-beetles.			
Before planting and when insects appear.	Beets and nearly all garden crops.	Plant-bugs, *Lygus pratensis*, etc.	Flattened, sucking bug, nearly one-fourth inch long when full grown, brownish in color, marked with yellow and black. Hibernates under grass and rubbish.	Sucks juices, causing plants to wither and often carries disease from sick plants to others.	Burn all rubbish in spring if this was omitted in fall. Spray young bugs with kerosene emulsion diluted with 12 to 15 parts of water. Collect old bugs by sweeping plants with cheese cloth or muslin net when insects are stupid in early morning or when it is cold.

*** Crops are arranged in alphabetical order from this point.**

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insects	Character of injury	Remedies to use
See p. 79.	Beets.	Flea-beetles.			
See p. 78.	Beets.	Cutworms.			
See p. 78.	Beets.	Grasshoppers.			
At planting time and as needed afterwards.	Cabbage, radish, turnip, cauliflower, cruciferous crops.	Cabbage maggot, *Pegomya brassicae*.	Adult fly resembles the housefly but is small and rests on the ground in gardens, flying up when disturbed. Larva is a whitish maggot, one-third inch long when mature.	Several maggots may work on the same root. They scrape away the outside tissue and cause rot to start and also bore tunnels through roots. Radishes are often rendered unmarketable from being burrowed.	Put a teaspoonful or more of tobacco dust around the stem of each plant at setting time, and renew the application once per week for three weeks after planting. Removing plants from ground, cleaning by hand and resetting is sometimes practiced with good results. Carbolic emulsion made as follows is often used: stock solution, 1 lb. hard soap dissolved in one gallon of boiling water; add one pint crude carbolic acid and emulsify at once by pumping the liquid back into itself with a force pump. Dilute with 30 parts of water, and pour one-half pint around each plant. This saturates the soil and destroys the maggot.
Begin soon after setting and continue through season.	Cabbage, cauliflower and other cruciferous crops.	Imported cabbage worm, *Pontia rapae*.	Butterfly white, expanse 2 inches, fore wing tipped with black, pair black spots on each fore wing, a black spot on each hind wing; males, one spot on each fore wing. Caterpillars, velvet green, over one inch long when mature.	Eats leaves full of holes, sometimes delaying growth and heading for several weeks.	When plants are young, spray with arsenate of lead or Paris green. If desired, combine poison with Bordeaux and put in one pound of dissolved soap with each ten gallons of spray to make it stick. After heading commences, do not use poison, but mix one part by measure of pyrethrum with 4 parts of flour and dust over the plants when the dew is on in the morning. About one dusting should be given each week.
Soon after plants are set and as often as necessary.	Cabbage, cauliflower and cruciferous crops; also celery, lettuce, beets and other garden crops.	Common cabbage looper, *Autographa brassicae*.	The larva is a green worm, lined with white, over one to one and one-quarter inch long when grown. Has the looping habit like the span worm.	Same as with preceding species.	Same as for Imported Cabbage Worm. Both species may be controlled with hot water, the temperature of which should be from 150° to 160° when it reaches the worms by spraying. Spraying with salt water is also useful.

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
Soon after plants are set and as often as necessary.	Cabbage and cruciferous crops.	Diamond-back moth, *Plutella maculipenis.*	The larva is a very small green worm. The moth is about one-third inch long and folds its wings roof-like over its body. A white line borders the inside of each fore-wing and these coalesce to form a single white stripe down the back with diamond-shaped expansions at intervals when the wings are folded.	Larvae usually feed on lower surface of leaves and not until quite numerous do they eat holes clear through.	Same as for other cabbage worms.
See p. 78.	"	Cutworms.			
Soon as insects appear which may be as soon as plants are set.	Cabbage, cauliflower and most garden crops.	Flea beetles, *Phyllotreta vittata, Phyllotreta pusilla,* etc.	Minute beetles that jump like fleas, sometimes called "garden fleas."	Adult beetles eat epidermis through in spots, making the leaves appear blotched over with minute spots. Damage may proceed further and considerable portions of the tissue be eaten.	Spray with arsenate of lead in Bordeaux mixture. Bordeaux alone has considerable repelling power against these insects. Spray at once as soon as the beetles appear. See page 79.
April and May before regular crop is planted.	Cabbage, cauliflower and other cruciferous crops.	Harlequin cabbage bug.	One of the stink bugs, often called the "calico back." Darker portions of body are shining black or dark blue. The spots are yellow or red.	Sucks sap from leaves causing them to wilt. May destroy an entire field of plants	Plant an early trap crop of mustard, r dish, rape or other cruciferous plants and when bugs are collected on the traps spray with pure kerosene, or kerosene emulsion diluted with 4 parts water; or collect insects by sweeping with a hand net and burn. If early insects are destroyed later ones will not follow.
	Cauliflower.		See Cabbage insects, pp. 81-82.		

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
Soon as plants are through ground.	Cucumbers, squashes and curcurbits of all kinds.	Striped cucumber beetle, *Diabrotica vittata*.	Small beetle, 1-5 in. long, straw-yellow in color with two black stripes on each wing cover. The inner stripes of each wing coalesce when the wings are closed, making one stripe, thus giving the appearance of three black stripes on the back when the insect is at rest. The larvae are long, slender, whitish worms, somewhat resembling wireworms but not so tough skinned.	The adult beetles collect on the stems just at the surface of the ground and gnaw the epidermis; also may eat holes in leaves. The larvae burrow through the stems and roots, causing the plants to wilt and die, especially in dry weather.	Put a large tablespoonful of tobacco dust around each stem as soon as the plant appears and likewise sprinkle the dust over the leaves when the dew is on in the morning. Repeat the tobacco applications once per week and always after a rain. The vines should be kept well covered for several weeks after the plants start. A mixture of one pound of flowers of sulfur to three pounds of dry-slaked lime may also be used for dusting, but should not be put about the roots like tobacco dust. Spraying with Bordeaux mixture to which arsenate of lead has been added is of considerable value. Early varieties may be started under glass and transplanted to the field, attaining considerable strength before the beetles appear. Successive plantings on the same land are successfully used by some. The newer plants are attacked and the older ones unmolested.
Soon as plants are through the ground.	Cucumbers and other cucurbits, corn, etc.	Twelve-spotted cucumber beetle, *Diabrotica 12-punctata*.	Greenish-yellow beetle, ¼ inch long, with six black spots on each wing cover.	Similar to that of preceding species.	Same as for striped cucumber beetle.
Soon as bugs appear.	Cucumber, cucurbits and many others.	Melon louse, *Aphis gossypi*.	Blackish-green plant louse, both winged and wingless forms occurring.	Insert their beaks into leaves and suck sap.	Keep a lookout on undersides of all leaves for first comers and destroy by burning the affected leaves. If the insects have appeared, spray with fishoil-soap kerosene emulsion to which pyrethrum has been added. Have an adjustable nozzle or a bent extension rod that enables the operator to throw the spray upwards against the under sides of the leaves. Dilute emulsion with 12 to 15 parts of water. Dusting under sides of leaves with pyrethrum is of value when only needed on a small scale.
See p. 78.	Same as above.	Cutworms.			
When insects appear.	Lettuce.	Aphis or green fly.	Greenish lice.	Suck juice from plant in greenhouses.	Use abundance of tobacco dust about roots and sprinkle over leaves. Fumigate with nicotine or tobacco. Tobacco dust worked into the soil.

INSECTS OF THE VEGETABLE GARDEN.

Date of treatment	Crops subject to attack	Name of insect	Description of insect	Character or injury	Remedies to use
When insects appear.	Lettuce.	Lettuce earth-louse, *Rhizobius lactucae.*	Dull white louse with dusky legs and antennae.	Suck juices from root	Drench roots with decoction of tobacco made by boiling 1 lb. of cheap or refuse tobacco for 1 hour in water. Dilute to 1 gallon of liquid for each pound of tobacco used.
"	"	Cutworms see p. 78.			
"	"	Cabbage looper, *Autographa brassicae.* See p. 81.			
"	Melon.	Melon louse, *Aphis gossypi.* See p. 83.			Same as when on cucumber.
"	"	Striped cucumber beetle *Diabrotica vittata.* see p. 83			"
"	"	Twelve spotted cucumber beetle, *Diabrotica 12-punctata* See p. 83.			"
"	"	Cutworms See p. 78.			
"		Flea-beetles. See p. 79.			

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
Egg laying begins in May.	Onion.	Imported onion maggot.	Adult insect resembles small housefly. Small white maggot resembles the cabbage maggot.	Maggots cut into bulbs, causing them to decay. Eggs are laid on young plants early in spring; several generations per season.	Read section on cabbage maggot, p. 81. Good results have been obtained in some cases by taking a cupful of sand, soaking the same in kerosene then mixing with a pailful of dry sand and scattering it along the rows at the bases of the plants. This repels adults, prevents egg-laying and kills any young larvae that may try to penetrate through to the plants. Lift out and destroy all badly infested plants as soon as they begin to wilt. Use commercial fertilizer freely to stimulate plants to outgrow injury.
Soon after young onions start into growth.	Onion, cives.	Black onion fly, *Tritoxa flexa.*	Adult is two-winged fly about ⅛ inch long, body black, three oblique white bars on each wing. Maggot white; larger than that of the Imported Onion Fly	Feeds on onions in field and in storehouse.	Same as for Imported Onion Fly. Infested onions in store should be fumigated with bisulphide of carbon for 48 hours, one pound of liquid to each 100 cubic feet of space to be treated.
"	Onions and supposed also to attack various field and garden crops.	Barred-wing onion maggot, *Chaetopsis aenea.*	Adult is metalic bluish-green, two-winged fly, about ¼ inch long, wings transversely crossed by three smoky bands, the outer ones coalescing at each end.	"	As for the preceding species. The usual period of severe attack is later in the season than spring, but young plants being transfered from hothouse to field should be examined and, if infested, even in slight degree, should be dipped into strong tobacco decoction or kerosene emulsion diluted with ten parts of water.
At planting time and afterwards whenever necessary.	Onions and nearly all garden vegetables.	Onion thrips, *Thrips tabaci.*	Minute, active, yellowish insects not over 1-20 inch in length. The four wings are very slender and fringed with long delicate hairs. Have the habit of elevating their abdomens and jumping like fleas.	Parent insects usually found on lower sides of leaves while both old and young are found under leaf-sheaths of plants. They scrape the tissue — minute spots, giving a whitish, blighted appearance to plants, especially after they begin to wilt for want of juice under prolonged attack. The leaves and tops decay in wet weather and rotting may extend to the bulbs.	All grasses, weeds, etc., in proximity to onion fields should be burned over in spring or plowed under to destroy the hibernating insects. Spray with kerosene emulsion or tobacco water whenever necessary. Drenching plants with a hose is useful.

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
Do not usually appear until late May or June. Read "Remedies" in 6th column at planting time.	Peas.	Pea aphis or louse, *Nectarophora destructor.*	A pea-green louse less than one-fourth inch long in case of females.	The lice gather in clusters about the terminals, and as they multiply, attack both leaves and stems, sapping the vines to death.	Spray with kerosene emulsion diluted with 12 parts of water. Wet both upper and under surfaces of leaves thoroughly. Early plantings of early varieties are seldom attacked. Rotate crops and in an infested district do not plant peas near fields which were planted to legumes the preceding year.
At planting time.	Peas.	Pea weevil, *Bruchus pisorum.*	Stout, chunky beetle about one-fifth inch long, dark brown in color and having black and white markings.	A minute dot is the only evidence of infestation in green peas. The adults issue from the dried peas through round holes.	If seed is kept over for two years all weevils will be dead, since they do not breed in dried peas after the manner of the bean weevil. Do not allow the issued weevils to escape to the fields to perpetuate their injuries. If it is desired to plant seed produced the preceding year, fumigate with bisulfide of carbon as directed for the bean weevil.
		Seed corn maggots, *Pegomya fusciceps.* See page 80.			
As soon as vines are 6 in. high or earlier.	Potato.	Potato beetle, *Leptinotarsa 10-lineata.*	Chunky beetle, approaching hemispherical form. Light yellow in color, with ten black stripes down the back. Length, one-half inch. Larvae are soft round slugs ornamented with black dots.	Both adults and larvae are provided with biting mouth parts and devour the foliage, sometimes stripping off all leaves.	Spray with arsenate of lead or Paris green. Combine these with Bordeaux mixture and spray at same time for blight. Dusting with Paris green mixed with 20 parts by measure of lime dust is practiced by some. Hand-picking in early spring is very satisfactory on small areas. Throw the captured beetles into pails containing water and a little kerosene.
	Potatoes.	Flea beetles, *Epitrix cucumeris*, et al. See page 79.			

INSECTS OF THE VEGETABLE GARDEN.

Date of treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
Whenever the insects appear.	Potatoes.	Aphids or lice, various spp.	Small greenish lice.	Suck juices from leaves, causing wilting.	Spray with kerosene emulsion.
Soon as plants are up.	Radish.	Cabbage maggot or radish maggot.	See page 81.	Erode skins and burrow through roots.	Same as for cabbage. See page 81.
	Squash.	Cucumber beetle, *Diabrotica vittata*. See page 83.			
At planting time.	Squash and all cucurbits.	Squash bug, *Anasa tristis*.	One of the "stink bugs" about ¾ inch long, dull blackish brown above, mottled yellowish beneath.	Suck the sap from the stems and leaves, causing wilting. May transmit vegetable diseases from plant to plant.	Plant some hills of squash earlier than main crop to serve for traps. Traps of squash or pumpkin will partially protect other cucurbits. Place shingles and pieces of board about the garden and look beneath them each morning in the early season for the bugs which should be destroyed.
Soon as weather is warm and frosts are over so seed can be planted.	Pumpkins, etc.	Squash-vine borer, *Melittia ceto*.	Moth has expanse of 1¼ inches, and is reddish brown marked with black or bronze, fore wings olive brown with metallic reflections, hind wings clear. Larva soft, whitish and grub-like. Nearly one inch long when full grown.	Larvae bore tunnels in stems and descend to root, being usually found near the level of the soil, sometimes a little above, again a little below. It causes wilting of vines as if attacked by bacterial disease. Yellowish sawdust-like excrement is found on ground under burrows.	Plant summer squashes for traps as early as possible on ground which is intended for main and later crop. Let these grow between the rows of the main crop until they are well stocked with borers, then pull up and burn. Other remedies belong to Summer Manual.
	Sweet Corn.	Same insects that affect field corn. See section on Corn Insects, p. 34.			

INSECTS OF THE VEGETABLE GARDEN.

Date for treatment	Crops subject to attack	Name of insect	Description of insect	Character of injury	Remedies to use
	Sweet potato.	Flea beetles, various spp. See p 79.			
When damage appears.	"	Tortoise beetles, *Cassida* spp.	Small beetles more or less resembling lady bugs or, even more strikingly, miniature tortoises. They often resemble burnished gold in color.	Eat numerous round holes in the leaves.	Spray with arsenate of lead if injury threatens to become serious.
	"	Cutworms, See p. 78.			
	Tomato.	Cutworms, See p. 78.			

APPENDIX.

RECORDS OF BIRD MIGRATION.

The following records of bird migration were made by Mr. Scott Harry who has, for several years, been employed by the Horticultural Department of the Ohio Experiment Station, and by Mr. Albert I. Good, formerly a student at the University of Wooster, and also at one time employed as an entomological collector by the Experiment Station. Both gentlemen are well qualified to make such records and their work may be relied on as being accurate The records were all taken at Wooster. The notes are largely based upon Dawson's Birds of Ohio. Such an entry as 3-11 in the date column for any year means March 11, etc.

	Date of record—Harry.								Date of record—Good.								
	1901	1902	1903	1904	1905	1906	1907	1908	1899	1900	1901	1902	1903	1904	1905	1906	
Blackbird, Red-shouldered	3-11	2-28	1-19	3-9		3-28	3-2	3-11	3-10	3-7	3-10	2-27	3-5	3-16	3-11	3-9	Summer resident in ponds and marshes.
Bluebird	1-1	1-20	1-?	1-?	2-3	1-21	2-28	2-12	3-2	2-10	2-7	2-8	2-9	3-1		2-22	Summer resident. Winter resident in southern Ohio.
Bobolink	5-2	4-29	5-1	4-24	4-21	4-?	4-28	4-23	4-29	4-28	5-6	4-30	4-29	4-28	4-28	4-25	Summer resident in northern Ohio. Migrant only in southern Ohio.
Bunting, Black-throated	5-31																Not plentiful. Rare or wanting in northern and eastern Ohio.
Bunting, Indigo	5-12	5-11	5-15	5-8	5-7	5-6	5-13	5-14	5-11	5-14	5-10	5-3	5-12	5-7	5-5	5-4	Summer resident. Breeds throughout the state.
Catbird	5-4	4-27	4-30	5-1	4 29	4-28	4-29	4-24	5-2	5-1	5-10	5-1	5-2	5-5	5-1	4-27	Summer resident. Breeds in bushy tangles everywhere.
Chat, Yellow-breasted	5-30	5-1	5-8	5 8	5-7	4-29	5-8				5-11	2-6	5-8	5-5	5-5	5-4	Abundant in southern Ohio; less so in north. Nests in briar thickets.
Cowbird	3-16	3-12	3-13	3-26		4-2	3-17	3-13	4-12	4-12	3-23	3-27	3-18	3-21	3-15	3-29	Common summer resident. Appropriates nests of other birds.
Creeper, Brown	2-13	2-6	1-9	4-4	3-25	3-16	1-11	2-28			4-6	4-4	3-23	4-4	3-22	4-12	Winter resident in southern Ohio. Casual winter visitor in northern section.
Crow									2-20	1-20	2-15	2-11	2-10	2-9		1-14	Common winter and summer. Partially retires from northern half of state in winter.
Cuckoo, Black-billed	5-24		5-15												5-5	5-14	Not abundant. Summer resident in northern Ohio; less common southerly.
Cuckoo, Yellow-billed	5-14	5-15	5-9	5-28	5-14	5-14	5-15	5-16	5-13	5-19	5-22	5-12	5-19	5-27	5-25	5-13	Common summer resident. Not so abundant northerly.
Dove, Mourning									2-20	3-24	2-3	3-10	3-9	3-20	3-17	4-1	Common summer resident. Winter resident in southerly part of state.
Finch, Purple	3-27						5-8							4-30		4-21	Spring and fall migrant. Occurs casually in winter.
Flicker									2-17	3-14	2-15	1-6	1-1	3-7	3-4	2-20	Not uncommon. Sparingly resident, most commonly in southern Ohio.
Flycatcher, Acadian	6-9	5-17	5-15	5-8	5-21	7-9											Abundant summer resident.
Flycatcher, Crested	5-10	4-27	5-4	5-3	5-7	5-13	5-18				5-9	4-28	5-7	5-5	5-5	4-30	Common summer resident all over state.
Flycatcher, Least	5-15	5-13	5-8	5-12	5-4	5-13	5-12			5-9	5-6	5-7	5-2	5-5	5-1	5-11	Common migrant. Occasionally summer resident.

RECORDS OF BIRD MIGRATION. Continued.

	Date of record—Harry.								Date of record—Good.								
	1901	1902	1903	1904	1905	1906	1907	1908	1899	1900	1901	1902	1903	1904	1905	1906	
Flycatcher, Traill's	7-13	6-15	5-9				6-10	5-15			5-3	5-6	6-3	5-21	6-5	5-18	Summer resident. Nests in willows and alders of swamps.
Gnatcatcher, Blue-grey												5-1	4-18	4-23	4-15	4-14	Abundant summer resident; less common in northern portion.
Goldfinch	3-25	1-10	1-16	1-14	1-9	2-10	2-4	2-12									Summer resident; partial winter resident.
Grackle, Bronzed	2-15	3-1	3-9	1-22		3-5	3-11	3-6	3-1	3-8	2-15	3-3	3-7	3-1	3-4	1-14	Common summer resident. Casual winter resident.
Grosbeak, Red-breasted	5-2	5-1	5-2	5-7	5-4	4-29	5-2	5-1	5-2	5-1	5-10	5-1	5-2	5-5	5-1	4-30	Summer resident; not abundant.
Heron, Green									5-3	5-5	4-27	5-12	5-6	5-21	5-1	5-10	Summer resident; nests in bushes or trees adjacent to swamps.
Hummingbird, Ruby-throated	5-13	5-16	5-14	5-16	5-7	5-18	5-13			5-6	5-16	5-7	5-30	5-21	5-5	5-7	Common summer resident.
Kingbird	5-1	4-27	4-30	5-6	4-30	4-29	4-29	4-26	5-1	4-30	5-4	5-3	5-7	5-3	5-2	4-27	Common summer resident.
Kinglet, Golden-crowned	1-14	1-1	2-7	3-1	2-10	4-1	2-10	1-12	4-8	4-6	4-30	4-21	3-18	4-4	3-23	4-4	Winter resident and migrant.
Kinglet, Ruby-crowned	4-27		5-2	5-12	4-30		5-4	5-6			4-17	4-24	4-18	4-25	4-12	4-15	Spring and fall migrant. Nests in Canada.
Martin, Purple	3-26	3-26	4-2	3-24	4-9	4-13	4-28	4-7	4-9	4-3	4-6	4-13	4-11	3-24	4-22	4-12	Summer resident. Common in cities and villages.
Meadowlark	1-2	2-6	3-5	3-2		1-?	3-11	3-11	3-6	3-10	3-4	2-28	3-6	3-7	3-7	2-22	Abundant summer resident. Winter resident in southern Ohio.
Nighthawk	5-17	5-8	5-11	5-7	5-8	5-12	5-19	5-15		5-26	5-18	5-4	5-8	5-7	5-12	5-15	Abundant migrant; sparing summer resident.
Nuthatch, Red-breasted			10-16	5-10		1-?	1-?	1-1			5-4	5-7					Spring and fall migrant. Occasional winter resident in southern portion.
Oriole, Orchard	5-4	5-1	5-3	5-8	4-30	4-21	5-10	5-10		5-3	5-4	5-1	5-7	5-5	5-2	4-30	Summer resident; not numerous.
Oriole, Baltimore	5-1	4-27	4-29	5-3	4-29	4-28	4-30	4-25	4-26	4-24	5-1	4-30	4-29	5-2	4-28	4-27	Common summer resident.
Ovenbird	5-14	5-12	5-2	5-15	5-4		4-28	5-7		5-5	5-20	5-7	4-18	4-30	4-28	5-11	Abundant summer resident.
Pewee, Wood	5-7	5-4	5-12	5-6	5-6	5-13	5-12	5-16		5-12	5-7	5-4	5-11	5-7	5-6	5-7	Abundant summer resident.
Phoebe	3-21	3-15	3-17	3-24	3-18	4-1	3-17	3-13	4-8	4-16	3-19	3-15	3-21	3-22	3-22	3-27	Common summer resident.
Redstart, American	5-18	5-12	5-8	5-15	5-2	5-2	5-11	5-11			5-18	5-4	5-2	5-7	5-2	5-7	Summer resident; most numerous during migration period.
Robin, American	2-3	1-8	1-16	1-13	1-22	1-2	2-17	1-19	1-14	1-18	2-15	2-23	1-1	2-13		1-14	Abundant summer resident; occasional winter resident.
Sapsucker, Yellow-bellied									3-11	3-3	1-14	4-11	4-6	4-23	4-7	4-15	Common migrant in spring and fall.
Shrike, Northern	2-9																Migrant in spring and fall; occasional winter resident.
Shrike, White-rumped	3-19	3-9	3-11	4-24	4-27		4-8		4-8	4-6	5-3		5-16		5-1	4-7	Summer resident.

RECORDS OF BIRD MIGRATION. Continued.

	Date of record—Harry.								Date of record—Good.								
	1901	1902	1903	1904	1905	1906	1907	1908	1899	1900	1901	1902	1903	1904	1905	1906	
Sparrow, Chipping....	4-11	4-5	3-19	3-29	3-26	4-5	3-24	3-27	4-12	4-8	4-5	3-28	3-23	3-25	3-23	4-2	Summer resident; winter resident in southern portion of state.
Sparrow, Field	3-25	3-24	3-18	3-24	3-22	4-4	3-23	3-18	4-15	4-7	3-28	3-22	3-18	3-23	3-18	4-4	Common summer resident.
Sparrow, Fox.....	11-9		4-18	5-15	3-25		3-31					4-11	4-11	4-4	3-25	4-2	Common fall and spring migrant.
Sparrow, Grasshopper.	4-26	4-24	4-25	5-12	4-27	4-29	4-28	5-3		5-12	4-25	4-25	4-22	4-23	4-13	4-14	Common summer resident.
Sparrow, Lark	6-10											5-30					Summer resident in southern Ohio. Not plentiful.
Sparrow, Song.....	1-1	1-5	1-?	1-?	1-?	1-?	1-?	1-1									Resident all over state; sparingly so in northern Ohio
Sparrow, Swamp		2-15	5-2				4-28										Common migrant; casual resident.
Sparrow, Vesper.....	3-25	3-26	3-18	3-24	3-25	4-4	3-21	3-22	4-6	4-18	3-28	3-22	3-18	3-22	3-23	4-2	Abundant summer resident.
Sparrow, White-crowned	5-4	5-11	5-10	5-8	4-30	5-2	5-11	5-10	5-9	5-12	5-4	5-3	5-14	5-7	5-5	5-7	Spring and fall migrant.
Sparrow, White-throated.....	5-4	4-27	4-25	4-26	4-21	4-16	4-21	4-22	5-4	5-8	5-4	5-3	4-29	4-30	4-13	4-25	Abundant spring and fall migrant. Winter resident in southern Ohio.
Swallow, Barn.....	4-13	4-16	4-16	4-17	4-21	4-13	4-24	4-19	4-12	4-16	4-10	4-14	4-11	4-23	4-20	4-21	Summer resident. Less plentiful than formerly.
Swallow, Cliff.....	5-13	5-9	4 25	4-24	5-30		5-11					4-28	5-13	5-7	5-13	4-30	Summer resident. Not common.
Swallow, Rough-winged	4-28	5-17	5-2					5-3	5-2	4-28	4-27	5-1	4-18	4-30	5-1	5-3	Resident. Usually found along streams.
Swallow, Tree.....		4-14	5-3									5-14					Spring and fall migrant. Occasional summer resident.
Tanager, Scarlet.....	5-4	5-1	5-2	5-8	5-4	5-6	5-12	5-14	5-24	5-5	5-9	5-12	5-2	5-5	5-5	4-27	Summer resident.
Thrasher, Brown	4-26	4-22	4-10	5-1	4-21	4-24	4-28	4-12	4-15	4-18	4-16	5-1	4-17	4-23	4-15	4-13	Summer resident. Not numerous.
Thrush, Hermit.....	4-12	4-14	5-2	5-8	4-30		4-21	4-12		4-21	4-13	5-4	4-22	4-23	4-13	4-26	Spring and fall migrant.
Thrush, Louisiana Water..... ..	7-31		4-2b	5-8	5-21	4-29	4-21	4-12								4-14	Summer resident; found along streams and in wild spots.
Thrush, Olive-backed.				5-12			5-13							5-7	5-20		Spring and fall migrant.
Thrush, Water	9-26	5-17					5-3										Common migrant, usually follows streams or woodland swamps.
Thrush, Wilson's.....			5-4	5-15	5-7		5-15	5-10				5-14			5-2	5-7	Common migrant. Occasional summer resident, especially in northern Ohio.
Turush Wood	5-1	5-1	5-2	5-6	4-29	5-13	5-12	5-3		5-5	4-30	4-28	5-7	4-30	4-28	4-30	Common summer resident.
Vireo, Blue-headed ...	5-15	4 25			5-4									5-7	5-5	5-11	Common spring and fall migrant.
Vireo, Red-eyed... ..	5-13	5-6	5-15	5-8	5-7	4-7	5-18	5-15	5-13	5-30	5-11	4-28	5-8	5-7	5-1	4-30	Abundant summer resident.
Vireo, Warbling	4-30								4-26	4-23	4-29	4-22	4-29	5-2	4-28	4-27	Summer resident: most common northerly.
Vireo, White-eyed....		5-2															Summer resident in southern Ohio; rare in northern part of state.

RECORDS OF BIRD MIGRATION. Continued.

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	1901	1902	1903	1904	1905	1906	1907	1908	1899	1900	1901	1902	1903	1904	1905	1906	
Vireo, Yellow-throated	5-1	5-12	5-4	5-8	5-3	4-29	4-28	5-3									Summer resident; common during migration.
Warbler, Black and White	5-4	5-1	5-4	5-12	4-29		5-11	5-5	5-9	5-5	5-4	4-28	5 6	5-5	5-1	5-4	Common migrant; occasional summer resident.
Warbler, Bay-breasted	5-18	5-13		5-12			5-19	5-16		5-9	5-20	5-13	5-13	5-7		5-14	Regular spring and fall migrant, not numerous.
Warbler, Blackburnian	5-23	5-2	5-12	5-12			5-16	5-16			5-18	5-7	5-13	5-7	5-1	5-4	Abundant spring and fall migrant.
Warbler, Black-throated Blue	5-8	5-10	5-4	5-9	5-5	5-6	5-11			5-7	5-20	5-1	5-6	5-5	5-1	5-7	Common spring and fall migrant.
Warbler, Black-throated Green	5-5	5-2	4-29	5-3	4-30	5-13	4-29	5-3			5-20	5-4	5-18	5-7	5-1	4 30	Common spring and fall migrant. Rare summer resident north.
Warbler, Black Poll					5-21		5-26	5-15		5-7							Late spring and early fall migrant.
Warbler, Blue-winged		6-10	5-15	5-8	5-7	4-29							5-13	5-7	5-2	4-30	Summer resident.
Warbler, Cape May			9-27	5-16	5-7											5-13	Rather uncommon migrant.
Warbler, Canadian			5-15	5-15		5 6	5-11				5-18		5-20			5-7	Common spring and early fall migrant.
Warbler, Cerulean			5-15														Common migrant. Occasional summer resident.
Warbler, Chestnut-sided	5-15	5-12	5-12	5-6	5-4	5-14	5-14	5-16		5-12	5 18	5-4	5-13	5-7	5-5		Common migrant. Rare summer resident in northern part of state.
Warbler, Connecticut			5-21														Rare migrant.
Warbler, Golden-winged													5-14			5-7	Migrant. Rare summer resident in northern part of state.
Warbler, Kentucky			5-21														Summer resident in southern Ohio. Rare elsewhere
Warbler, (Northern Maryland) Yellow-throat	5-13	5-4	5-2	5-8	5-2	4-29	4-28	5-3	5-9	5-5	5-4	4-28	5 6	5-5	5-1	4-30	Common summer resident in swamps and lowland thickets.
Warbler, Magnolia	5-15	5-12	5-4	5-10	5-4		5-13			5-9	5-9	5-1	5-13	5-7	5-5	5-13	Common spring and fall migrant.
Warbler, Mourning				5-15													Common spring and fall migrant.
Warbler, Myrtle	5-1	4-25	5-2	4-30	4-27	4-30	4-30	4-22		5-12	5-1	5-8	5-7	5-7	5-1	4-21	Common migrant in spring and fall.
Warbler, Nashville											5-6		5-7	5-7		5-4	Common spring and fall migrant.
Warbler, Palm			5-3												5-1	4-30	Common migrant in spring and fall.
Warbler, Parula		5-2	5-8				5-11							5-7			Rare migrant. One form is summer resident. Not common.
Warbler, Tennessee				5-18													Common spring and fall migrant.
Warbler, Wilson's	5-22	5-12		5-15			5-19				5-20	5-14	5-12				Spring and fall migrant. Found in thickets.

RECORDS OF BIRD MIGRATION. Concluded.

	Date of record—Harry.								Date of record—Good.								
	1901	1902	1903	1904	1905	1906	1907	1908	1899	1900	1901	1902	1903	1904	1905	1906	
Warbler, Yellow.....	4-28	4-27	4-28	4-27	4-21	4-25	4-29	4-23	4-24	4-23	4-27	4-24	4-28	4-30	4-25	4-21	Rather common summer resident.
Warbler, Yellow-throated (Sycamore).				5-13													Sparse summer resident in southern half of state.
Waxwing, Cedar.....	3-18	2-6	5-2	5-26	1-9	3-?		2-28									Summer resident and not uncommon in winter.
Whip-poor-will.....	5-6	5-15	5-9	5-28	5-14	5-14	5-15	5-16			6-12	5-1				5-14	Not uncommon summer resident.
Woodpecker, Red-headed									1-1	5-5	5-4	5-19	1-1	1-2	3-2	4-27	Common in summer, not rare in winter.
Wren, Carolina..	1-17	1-19		2-7	1-12	1-21	1-?	1-1									Rare in northern Ohio. Common and resident elsewhere.
Wren, House.....	5-2	4-25	4-13	4-28	4-23	4-22	4-28	4-20	5-5	4-28	5-2	4-23	4-18	4-25	4-22	4-26	Common summer resident.
Wren, Winter.....	2-15		4-25	4-19			4-28	5-3									Migrant in November to southward. Casual in winter.